NEWS AT BUT

2017/2018

BRNO UNIVERSITY OF TECHNOLOGY

Nobelist Claude Cohen-Tannoudji at BUT

Science is a never-ending process and scientists are perpetual students.

BRNO UNIVERSITY OF TECHNOLOGY

NEWS AT BUT

English Yearbook
issued by Brno University of Technology
ID 00216305, VUTIUM Press
Reg. no.: MK ČR E 7521, ISSN 2533-4700.

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Cover photo by Constantinos Emmanoulidis and Miroslav Druckmüller
Printed by Gill, s. r. o., Brno

Issue 2 | 2017/2018
Issued on 25 October 2017

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NOT FOR SALE!

Photo by Igor Šehr

Dear readers,

welcome to the second English edition of the magazine News at the Brno University of Technology (BUT). After a positive response from the first issue, we decided to continue in this tradition and publish the second edition for the international students, employees and partners of the largest technical university in the Czech Republic and the oldest university in Brno, as well as for everyone who is interested to learn something new about our university that achieves excellent results not only in education, science and research, but also in cooperation with the application sphere.
In addition, Brno University of Technology belongs to 2 % of the best universities in the world according to international rankings.

In the current edition you can read about the most important events and activities of the previous academic year 2016/2017, such as the R&D centre of excellence CEITEC BUT that launched the full operation of its laboratories, the first achievement of student Pneumobil team from FME, the new student formula Dragon 7 design, or that Jiří Klemeš who will lead the SPIL project at the NETME Centre, to name some.

I hope that the provided information about projects and activities will give you useful insights into BUT. If you would like to know more about the current developments at BUT, please visit the Facebook page of Brno University of Technology or the official website of the university: www.vutbr.cz/en

I wish you pleasant reading of BUT News,

Peter Nemec
Head of Foreign Relations Department

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The year 2016 marked the 140th anniversary of Viktor Kaplan. On this occasion, his granddaughter Gerlind Weber paid a visit to the Department of Fluid Engineering bearing the name of her grandfather.

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The works of Jaroslav Juřica, the BUT graduate, are poised between art and industrial design. In 2016, he received a Red Dot Design award for his kick scooter for the grown-ups.

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After thirty years spent at universities abroad, Jiří Klemeš is returning to the Czech Republic. At the NETME research centre of BUT, he will be leading the Sustainable Process Integration Laboratory project.

The CEITEC BUT laboratories are in full operation

In September 2016, the Central European Institute of Technology BUT (CEITEC BUT) officially put its new laboratories into operation. Located at the Pod Palackého vrchem campus, this site is what is called a European Centre of Excellence. Here, Brno University of Technology implements two CEITEC research programmes, focusing on advanced materials, nanotechnologies and microtechnologies, scientifically coordinated by Josef Jančář and Tomáš Šikola.

Radana Kolčavová
Photos by Igor Šefr

The new complex of four buildings was finished in late 2015 and put into trial operation. Gradually, laboratories from faculties and other sites temporarily hired by CEITEC BUT started to be moved while the technical parameters of the new buildings were being fine-tuned to fit the requirements of the sensitive and sophisticated equipment. Since September, the laboratories have been in full operation available to scientists and industrial companies much interested in applied research.

A scientific centre near Technology Park, for example, houses lab facilities that are much cleaner than operating theatres. Among the Czech

research institutes, these are the biggest clean laboratories facilities. A laboratory for analysing nanostructures is a place with a concentration of dust particles ten times lower than in a living room. And, a laboratory for preparing nanostructures with a much higher risk of a nanotechnological sample contamination registers even ten thousand times less dust particles per cubic foot and can only be accessed in a special laboratory suit.

"The labs are operated in an open-access mode being available to BUT researchers and doctoral students as well as to their colleagues from other Brno universities, research institutes, and industrial companies," said CEITEC BUT director Radimír Vrba describing the principle of shared laboratories. "The uniqueness of such research infrastructure consists in it being equipped with hundreds of top instruments of quality comparable with that found at the world's leading research laboratories and universities, all concentrated at a single site," added Michal Urbánek, who is in charge of the shared labs.

An ultra precision microscope for one, can measure with a precision of one nanometre per square inch. "To picture such a resolution, we can think of surveying the whole Brno area with with a half-millimetre resolution. The resulting map would have about 900 trillions data points and take up 2000 regular computer hard discs. There are only a few such devices in the world," this is how Petr Klapetek from the laboratory for the development of measuring methods explained the equipment uniqueness.

Other research teams are concerned with increasing the capacity of modern memory elements, robotics, and the development of drive electronics for small home appliances as well as for fully electric vehicles. A team led by Professor Jozef Kaiser, on the other hand, creates 3D models of soft tissues for a group of biologists from Karolinska Institutet in Sweden helping them discover the mechanisms participating in the shaping of animal faces. Professor Radim Chmelík, in turn, has created a unique microscope with which living cells can be observed without having to use contrast substances that could change the cell behaviour. In this way, scientists can see the cells alive in their natural environment.

"CEITEC BUT is a centre of excellence producing results that, in the future, can significantly help improve the utility values of materials, structures, machines and systems. Its contribution to the quality of life and health of people must also be considered," said BUT rector Petr Štěpánek adding that the centre also helps promote Brno and the South Moravian Region on the European scale. The construction of the four-building research complex with subterranean connecting corridors cost 625 million CZK. Another 800 million had to be paid for laboratory equipment and other leading-edge technologies for research teams. Most of the funding came from the EU subsidies.

The construction of the new laboratories started five years ago with trial operation launched three years later. The delays in the construction of a new research centre had also been caused by the previous ambiguous interpretation of the Public Procurement Act. "Modifications had to be cumulated to invite tenders for larger orders. In the event of a single tender, which was often the case, the tender had to be cancelled. This was exactly what occurred during CEITEC BUT construction," explained BUT bursar Ladislav Janíček.

"The ministry of education appreciates the fact that, despite all the difficulties faced by almost all research centre projects, a part of the project could be implemented creating a unique and leading infrastructure. CEITEC is a classic example of close and large-scale cooperation of several universities and the Academy of Sciences of the Czech Republic that has already achieved a number of first-class results and I believe that it will remain successful in the future with significant contribution from CEITEC BUT and that the project partners will manage much more when working together," added Kateřina Valachová, the former minister of education.

About the CEITEC project
Central European Institute of Technology is a research centre joining six Brno institutions as research partners – Masaryk University, Brno University of Technology, Mendel University, University of Veterinary and Pharmaceutical Sciences Brno, Institute of Physics of Materials of the Academy of Sciences of the Czech Republic, and Veterinary Research Institute Brno. CEITEC BUT has existed since 2011 in close cooperation with three BUT faculties – Faculty of Mechanical Engineering, Faculty of Chemistry, and Faculty of Electrical Engineering and Communication. Of CEITEC's seven research programmes, BUT coordinates an advanced materials programme and an advanced nanotechnologies and microtechnologies programme. ■

CEITEC BUT in numbers

9 – the number of research groups working in CEITEC BUT in all fields of research
1 – research infrastructure with clean facilities for nanotechnologies and advanced materials
250 – the number of scientists working at CEITEC BUT
50 – the number of doctoral students helping connect the centre's research and education activities
14 100 m² – the area of the new laboratories
2012 – the year in which the foundation stone was laid for CEITEC BUT
625 million CZK – cost of the four BUT CEITEC buildings
800 million CZK – cost of the centre's research instruments and leading-edge technology equipment

Science is never finished, says Nobelist Claude Cohen-Tannoudji

Radana Kolčavová
Photos by Igor Šefr

Professor Claude Cohen-Tannoudji, the 1997 Nobel Prize winner for physics, gave lectures for BUT students on 8th and 9th December 2016. During his two-day visit to BUT, he inspired young scientists to further study of physics and engineering. He met both doctoral students and academics to give them a spur to further research. His visit was organised by Honeywell as part of the Honeywell Initiative for Science & Engineering (HISE).

Claude Cohen-Tannoudji is a Professor of atom physics at Collège de France in Paris. In 1997, he won a Nobel Prize along with William Phillips and Steven Chu for the development of methods to cool and trap atoms with laser light. He also received a number of other awards such as Institute of Physics Prize, Lilienfeld Prize of the American Physical Society and Quantum Electronics Prize from the European Physical Society.

"Although the first lasers were looked down on as an oddity, today you can come across lasers in medicine, in DVD players, in bar code readers at shopping centres," enumerated the lively eighty-year-old Tannoudji. When lecturing, he did not forget to make a witty remark about the laser

pointer he was using. The main lecture, Science as an integral part of culture, presented scientific advances in the light of the progress of society using the theory of light as an example.

Taking place in the Professor Brauner Hall at the BUT Faculty of Electrical Engineering and Communication, the lecture was attended by about 300 people. "You have so many options of continuing your career," says Claude Cohen-Tannoudji. "Just look at your previous achievements and make every effort to reach your ambitions goals, which may seem unattainable. If you do it, you have a chance of succeeding."

Physicist Cohen-Tannoudji is among the 25 Nobel Prize winners whose lectures at universities have been organized by Honeywell since 2006. This year's visit of the Nobelist to BUT is the fourth in succession but third organized as part of the HISE programme. "Our cooperation with Honeywell helps students overcome the gap between the academic and professional worlds," said BUT rector Petr Štěpánek speaking about the rare visitor. "We believe that if we offer the students an opportunity to learn from a Nobel Prize winner and debate with Honeywell employees, this will spur them on to trying to be successful scientists and experts in research and technological development."

After the lecture, selected doctoral students could go to lunch with a Nobel Prize winner and see how thorny the way to world fame is.

The afternoon programme at BUT included an excursion to the clean laboratory facilities of the Central European Institute of Technology at BUT (CEITEC BUT) where the Nobel Prize winner was accompanied by Tomáš Šikola, director of the Institute of Physical Engineering at the Faculty of Mechanical Engineering and head of the programme Preparations and Characterisation of Nanostructures at CEITEC BUT.

"Politicians tend to provide funding only for research focused on particular applications. However, the basic research is the most fundamental part of science and cannot be foreseen. This is one of the reasons why basic research must stay free," accented the Nobelist. The BUT programme for Claude Cohen-Tannoudji continued on Friday 9th December in the morning by a colloquium for young scientists and doctoral students led by Tomáš Šikola with Atoms and Photons as the topic. This was followed by a popularizing lecture Ways to Discovery, in which Professor Tannoudji described his own way to the Nobel Prize.

"No doubt, scientific discoveries enrich mankind and, as such, may be regarded as an integral part of culture. They improve living conditions as well as moral standards and lead to open thinking. Science is the opposite of any form of intolerance," are his words appealing to the young audience. On this occasion, Cohen-Tannoudji pointed out the international dimension of scientific cooperation, which he thinks of as sort of a lingua franca. "Put simply, science has no limits," believes the renowned scientist.

According to him, it is important to offer children the scientific way of thinking as an alternative starting in the elementary school because such approach improves critical thinking and observation skills. During his visit to Brno, Cohen-Tannoudji remarked that he saw scientists as perpetual students who realize that they only know a fraction of what is yet to be discovered. "Science is never finished," this is one of the messages from the French professor, who did not fail to joke about Schrödinger's cat.

Honeywell's HISE programme is an initiative beneficent to society aiming to encourage students in pursuing their careers to reach their goals in research and engineering. Since 2006, Honeywell has organized lectures by Nobel Prize winners at leading universities in China, Czech Republic, India, Malaysia and Mexico.

"A Nobel Prize was won by my teacher and my first student as well," said the French physicist. Even with the busy schedule of his visit, Professor Cohen-Tannoudji could spare a few minutes for a short interview for News at BUT.

The reactions between light and matter had been known before. What exactly was the contribution of your team in this field?
Thanks to our discovery, now there are much more options available concerning the source of light. This is because we can use light sources of different frequencies and intensities. Now we can better control the interaction between light and matter, having more flexible instruments to do it so that we are able to slow down atoms and make them 'be at rest'. When atoms are cool, they are slowed down giving us a longer time to watch them and measure them with more precision.

Applications can be found, for example, in an atomic clock. There is also research of quantum gases, which utilizes atoms cooled down by a laser beam.

In your youth, what made you opt for an academic career rather than a well-paid job in the commercial sphere?
When I was studying, I met a number of outstanding professors presenting beautiful and elegant ideas. I was so enthralled by this that I decided to join them. I was not so much fascinated by money; I just wanted to do something beautiful and interesting so I started to teach. I enjoyed meeting students and exchanging ideas. I formed a group of students that was very successful: one of my first doctoral students also received a Nobel Prize. It was first given to my teacher Alfred Kastler in 1966, then to me in 1997 an then the Nobel Prize went to my doctoral student, too. It is sort of a tradition. I think that it is important that you should be enthusiastic about what you are doing because it doesn't work otherwise.

Have you ever felt like giving up all your effort in the academic sphere?
No, this has never occurred to me, I take this as a mission. The most important thing is that, in this work, you never do the same. You meet a lot of interesting people so I think that science is really enjoyable.

What would you advise to young scientists and doctoral students?
Hard work and enthusiasm are the two most important things. With such an extraordinary profession, you have to get at its roots to grasp the beauty of it. Understand all the concepts and ideas, meet students and, most of all, enjoy such meetings. ■

Who is Claude Cohen-Tannoudji?

- A Frenchman with Algerian background, born 1st April 1933 in Constantine, Algeria.
- He went to Paris to study at École Normale Supérieure.
- He taught quantum mechanics from 1960. In 1973, he got tenure as professor at Collège de France teaching molecular physics.
- He is the author of 210 theoretical and experimental studies concerned with diverse problems of atom physics and quantum optics.
- In 1997, he won a Nobel Prize along with William Phillips and Steven Chu for the development of methods to cool and trap atoms with laser light.
- His lectures given over a period of thirty years at Collége de France are available at the university website.
- Since 1958 he has been married to Jacqueline, a secondary-school teacher, who has been accompanying him during his visit to BUT.

Tribometers from FME are used by Japanese car factories

If you ask a passerby what tribology is, probably you won't get an answer. But, this field of science concerned with friction touches every one of us, even in the literal sense. Tribology examines the wear of hip or knee transplants for one. Friction is also at work when you clean your teeth or wear contact lenses.

Radana Kolčavová
Photos by Igor Šefr

"Our laboratory was built 25 years ago, but research in this field has a long tradition in Brno, dating from the first re search institute for antifriction bearings established in 1953, which means that tribologic re search in Brno has been going on for over sixty years," told us Ivan Křupka, the head of the tribology department at the Institute of Machine and Industrial Design of the BUT Faculty of Mechanical Engineering. Then he led us to a tribologic laboratory consisting mainly of optic tribometers. These are unique devices, which can create diverse model situations for the research of lubricated contacts depending on particular industrial applications. Tribometers use colorimetric interfero-metry – a method for studying lubricating films only several nanometres thick. Developed in the laboratory, this method allowed building research department that is unique both in the Czech Republic and abroad.

"In a tribometer of the basic type, the lubricated contact is created between a steel ball and a glass or synthetic sapphire disc. With some lubricant added, the parts are loaded and moved while their contact is observed through a transparent disc. We can observe how the lubricant responds to different operating conditions or how the surface roughness affects the lubricated contact," explained Křupka. Just for your information, a tribometer may cost from two to five... million CZK depending on the accessories so that one laboratory represents almost twenty million CZK in equipment.

Most cooperation requests come from abroad. "We have orders virtually from all over the world. Two tribometers, for instance have been made specifically for Japanese car industry," said Křupka, adding that there is a growing interest of domestic companies, too. Tribologists in Brno can also use a laboratory for simulating rail transport or a biotribologic laboratory for medical use with tribometers of peculiar design to simulate joint load during walking or jumping.

And what are they doing in the tribologic laboratory right now? "Currently, we are examining the way temperature affects a lubricated contact so we use an infrared camera to observe the reaction of lubricants during the slip of friction parts, when surfaces move at different speeds," described Křupka his work adding: "Another part of the team is studying a lubricated contact under dynamic conditions present in machines and caused by transversal or longitudinal vibrations," said Křupka closing the tour of the laboratory. ■

Examples of equipment found in a tribologic laboratory

Optical tribometer
Tribologic simulator developed at the laboratory can be used for experimental modelling of operating conditions occurring in machine nodes. Tribometer is available in the ball-disc configuration with optical interferometry, fluorescent microscopy and infrared radiometry.

3D optical profilometer
Optical profilometer with high speed, precision, and range for contactless 3D measurement of engineering surfaces (semiconductor parts, precision mechanical parts) including control software. This is one of the most advanced optical interferometric profilometers currently available in the market.

Tribometer Mini Traction Machine
A tribometer for measuring the friction characteristics of lubricated and non-lubricated contacts in a wide range of speeds and slips. One of the major applications using MTM is surveying lubricant tractions in conditions usually occurring in combustion engines. The software allows to define a testing profile containing a sequence of temperatures, loads and speeds, with complementary functions for measuring the wear of hard layers or soft contacts.

A unique Envihut project tests natural building

Zuzana Pospíšilová
Photo from Radim Kučera's archive

Although green roofs on houses seem to be a commonplace in the future, clear instructions as to what such a roof should look like do not exist. Different planting types as well as non-traditional building materials are, therefore, investigated by researchers at the BUT Faculty of Civil Engineering as part of a unique Envihut project. They built a small house at the AdMaS campus to monitor a natural building and its all-year-round behaviour.

Originally, Envihut was designed as a cooperation project between BUT and Reykjavik University to provide for testing non-traditional materials in real-life conditions rather than laboratories. "A suggestion came from Iceland to investigate green roofs in natural conditions. One thing is testing a green roof on a square sized 1 by 1 metre, which can readily be watered or cut and another thing is observing it on a real house doing nothing," said David Bečkovský, one of the project authors, explaining the reason why the project was designed.

Another reason is the legislation. "In England or Switzerland, preparations are already under way for green-roof-based reconstructions. Therefore, it is becoming part of the building market demand. Even if this may not be the case in the Czech Republic, it certainly is bound to come, so we ought to be prepared," added Petr Selník, who has long been in charge of green roofs in Envihut.

Envihut is situated on the AdMaS campus in Brno and exposed to sun, wind or frost. Apart from the researchers and students, it is visited by investors and those interested in natural building. "This is a building structure entirely different from those an ordinary builder is accustomed to. Usually, he works with familiar industrial materials with minimum production and function tolerances while here, the tolerance is up to 30 percent. It also helps investors and people interested in green roofs to get an exact idea what this is all about," explained Selník.

The researchers test several different approaches to green roofs. "Part of the roof of our house has been built according to the EU recommendation. But it also has a Swiss bio-diversified concept and an Icelandic version of green roof," said Bečkovský adding that they were looking for an ideal variant not requiring special interventions by humans.

The team also uses the house to test non-traditional materials for walls. According to Radim Kučera, who supervises the testing of building materials, the impulse has come again from the north. "On the house, we created about five testing fields with different material compositions and thermal insulation types. From the classic mineral wool used regularly to flax or cotton recyclates," specified Kučera.

The Envihut project has been created as part of the AdMaS UP project and supported from specific research projects of the Institute of Building Structures at the BUT Faculty of Civil Engineering. ■

The greatest reward would be if our work helped sick persons, says researcher Lucy Vojtová

Zuzana Pospíšilová
Photos by Igor Šefr and from Lucy Vojtová's archive

There are very few people in the Czech Republic knowing so much about biomaterials as Lucy Vojtová. She has been researching biomaterials over fifteen years and a number of the materials she has been working on is patent protected. Since she returned from the U.S., she has been teaching at the BUT Faculty of Chemistry and, for the last six years, doing research at the Central European Institute of Technology BUT.

Lucy Vojtova and her research team focus on materials used in healthcare with a strong emphasize on implants. "We are preparing new implants that can temporarily replace the injured tissue triggering regeneration and renewal of the original tissue. This applies to bones, skin, and now also to organs," explained Vojtová. The materials developed by her team will break down into non-toxic substances and get absorbed after some time.

Their work will help the future surgeons replace non-functioning tissue by absorbable implants. "Right now, for instance, we cooperate on heart regeneration after cardiac infarct with the ICRC = International Clinical Research Center at St. Anne's Hospital," added Vojtová.

Like many others, she must now look for new ways of advancing the field. The reason is that the European Commission has recently restricted the certification for the materials containing stem cells. Unfortunately, these are what the researchers have pinned all their hopes on. "Most of the materials that worked in regenerating animal tissues were based on stem cells. However,

the latest trend is not to use stem cells in new materials. There are concerns that their reproduction might go wild causing cancer. Articles started to appear on this topic and everybody has got frightened. This means that we're getting nowhere having materials known to work but being unable to disseminate them," explained Vojtová.

Although she still wants to investigate stem cells and their use in medicine, she will market only cell-free materials. "These are materials to which we add a protein shake, as we call it, rather than stem cells.

this way, the patient will only receive his/her own cells with no new ones added. We have already taken out a patent on this material type for bone regeneration. Now we would like to advance to cartilage or skin," described Vojtová.

Using 3D print to make absorbable implants is also a relative novelty. "The future artificial tissues are likely to be all 3D printed on a computer to make them customizable. In addition, we can print imitated tissues with different cells for watching the disease progress and reactions to drug administration such as in cancer

We are preparing new implants that can temporarily replace the injured tissue triggering regeneration and renewal of the original tissue.

The purpose is to stimulate the cells to move to the material placed in the injured tissue. In proliferation – in this way eliminating experiments on animals," said Vojtová listing the advantages of print in tissue engineering.

According to Lucy Vojtová, maintaining the development is a necessity to stay ahead. The reason is that the competition in tissue engineering is strong. "I learned about tissue engineering in the U.S. about fifteen years ago, but in the Czech Republic it arrived five years later. As we started early, we are still managing to be one step ahead. But now we have to make effort to see our materials being launched into the market rather than ending up in a drawer. This is why we are looking for the companies and sponsors who are willing to go into it," she added.

Lucy Vojtová says she does not regret choosing this particular avenue of research. If she were to make a new decision, the option would very likely be tissue engineering again. "I am certainly glad to have made such a decision. After the U.S. experience, tissue engineering became my favourite pastime. I like searching for new biomaterials with applications in medicine. Each biomaterial is

Each biomaterial is different due to the countless combinations of organic and inorganic input substances.

different due to the countless combinations of organic and inorganic input substances. It is interesting to watch whether what our team designs and produces really works," added Vojtová.

For her, the best reward would be the materials being really distributed and used in medicine on a regular basis. "This would be a satisfaction for all the work we put in. I am glad glad that it is Brno University of Technology where I can develop this new field and I am really grateful for the support I receive from Professor Jančář, the leader of the Advanced Polymers and Composites research group at CEITEC BUT," concluded Vojtová. ■

Who is Assoc. Prof. Lucy Vojtová, Ph.D.

In 1995, she finished her study of chemistry graduating from University of Pardubice.
Five years later, she defended a dissertation in macromolecular chemistry at the BUT Faculty of Chemistry.
In 1999, she stayed three months at University of Connecticut.
She spent the following three years at Columbia University in New York where she participated in a number of major research and development projects on biomaterials.

Since 2002, she has worked at the BUT Faculty of Chemistry leading a research and development team for polymer materials and biomaterials.
For the last five years, she has also worked at CEITEC BUT.

EVENT

Photo from BEST Brno archives

EBEC Final Round at BUT

For the first time, the finale of the European BEST Engineering Competition (EBEC) took place at Brno University of Technology, a meeting point of the best 116 teams in early August 2017.

Participating were also representatives from the hosting university as the HRW team of mechanical-engineering students was among those competing in the Case Study category. The BUT finalists had not taken the medal places in the end, but volunteers from the BEST Brno student organisation, who had been preparing for the most anticipated European event for over one year, gave perfect performance. "This year's competition was one of the two best if not the best," said Gunta Meluškane, the organizer of the 2014 finale in Riga, appraising the work of her Brno colleagues.

The winners, surprisingly in both categories, were teams from Romania. However, for the representatives of companies who take part in the competition, the winners were all. "All of them are winners because they have created something that really works," commented Marie Chaloupková from Y-soft not disguising her admiration for the competition level.

For more information, visit **https://ebec.best.eu.org/**

(ed)

SUCCESS

BUT has improved its QS World University Ranking

In the QS World University Rankings published in June 2017, BUT ended up in the shared places 601-650. Compared with last year's 651-700 ranking, it has improved also keeping its research potential marked as "very high", which is the highest grade.

BUT achieved the best position in the area of Engineering & Technology winning 262nd place and in the category of Structural and Civil Engineering with the shared 151-200th place.

The QS World University Rankings includes 26 thousand universities from all over the world, BUT's current result places it among the best 2.3 percent.

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Pneumobil team: with the new car design, we can reach for the top ranks

Although sounding like the names of Indian chieftains, Blowfish and Whirlwind are two compressed-air vehicles designed by a team from the BUT Faculty of Mechanical Engineering. Like every year, in May 2017 they participated in international races of compressed air vehicles in Eger, Hungary. We met Petr Kučera, a former leader of the Pneumobil Racing Team Brno at the Institute management at the Institute of Machine and Industrial Design. We wanted to know something about races and the future of the project as judged by the new asset of the team management.

Jana Novotná
Photos by Igor Šefr

Petr Kučera took me to the workshop where he works on project-oriented objects pushing out one vehicle. The other, nicer in my opinion, stayed in place waiting for being repaired after a crash. With sunbeams reflecting in the silvery hood, another team member squeezed into the cockpit and, in the typical hiss of leaking compressed air, the vehicle dashed forward surprisingly quickly.

What is the history of the Pneumobil project at the Institute of Machine and Industrial Design?
It might be good to say at the very beginning that the races as such have been around since 2008 mentored by Aventics, manufacturer of pneumatic systems. The beginnings of compressed air vehicles or CAV's at the institute date from 2011, when, supervised by Josef Nevrlý, two master's theses were written on this subject. The one by Martin Stodolák was concerned with the theoretical background of the drive while that written by Petr Podhorský already dealt with a CAV design. These two projects gave rise to two functional prototypes later presented at the Brno International Engineering Fair but never taking part in a race.

So when did the time come for the BUT CAV's to participate in the Eger races?
The first racing car built at the institute appeared in Eger under the name of Monster Trike although nicknamed Blowfish from the very beginning. In the historically first race of 2012, the BUT team won a prize for the best newcomer ending up second in the design category. The competition criteria included acceleration, timed driving, and maximum range. That a newcomer from BUT came in better than fifteenth in these categories may be taken as a sign of success. The 2013 season that followed in Eger was historically the most successful for our recast team. Since the 2014 season, the team has increased its fleet by a second, black-red vehicle called Whirlwind with both cars doing quite well while the 2015 season was unlucky for the team due to technical problems.

Before races in 2016, have you learnt a lesson from the previous mistakes?
With an idea to boost up its repute, the team focused on reliability in the 2016 season. We prepared two cars for the races. One is a white Blowfish with 4-piston drive and rack gearing mechanism where gears are changed in a semi-automatic sequential motorcycle gearbox. The power is transferred to the rear wheel by a belt. The car's electronic part consists of a PLC automaton using telemetry that makes it possible to have the operating parameters analysed and further optimised.

Then, there is a Whirlwind with black-red chassis, which is driven by one piston and a chain gear. The gears are changed electropneumatically and the gearbox originates from a passenger car. The power is further transferred to the rear wheel by a belt again. The electronic part of this car has been upgraded working now on an Arduino platform. Both cars work with an eight-bar pneumatic system with an option to switch between settings for different events.

How did this work in the races?
The white Blowfish started with a crew consisting of Tomáš Strmiska, Tomáš Buchta, Ondřej Svoboda, and Lukáš Navrátil while the black-red Whirlwind's team was formed by Tomáš Kroutil, Libor Danda, Josef Zvoníček, and Maxmilián Kvoch. In the acceleration, timed driving and maximum range events, the Blowfish team came in 15th, 12th, and 24th, respectively. The Whirlwind team ended up 16th in acceleration and 19th in maximum range. In timed driving, unfortunately, the car crashed and was disqualified. A major partial success was achieved by the Blowfish team ending up third in a project management category. Since the team was new without much previous experience, the expectations hadn't been too high. The aim was to finish among the first half of the competitors, which was achieved so that the overall result of this season may be rated as very positive.

How did it actually come about that you became the head of the team?
I share the leadership with Matúš Ranuša, who has been leading the team for more than two years. After Karol Sabo, his former partner, left BUT, he made an offer to me to join the project. As this was a unique opportunity to pass on my expertise and know-how to younger colleagues in project classes offered by the Institute of Machine and Industrial Design, it was impossible to decline. Of course, we all build on the work of Dan Koutný, who was at the birth of the project being its first leader.

What changes have taken place in your project?
There were a lot of changes in 2016, mostly personal. The managements of teams and sections were stabilised, which should result in the development of new cars being more efficient. New people joined the team such as experts in electronics, design and computer simulations.

What are you planning for in the next racing season?
We plan for creating a unique team to facilitate contact with partners and a wider public. We feel that there is a huge potential in numeric calculations, which should help us achieve a maximum optimisation level. A major task we are facing, however, is the development of a new car. We want to build on the findings we made during testing and races to come up with a brand new design bringing us closer to the top ranking positions.

How does a success depend on the funding available and what is your team's position in this respect?
As in any other motoring sport, money plays a major role. With sufficient funding, you can ignore any price considerations focussing all your energy and creativity on optimisation. Compared with our competitors, our budget for year 2016 was rather modest. The good news is that the most expensive components, basically including the entire pneumatic system, is provided by Aventics free of charge for all race participants.

Are you receiving some funding from the university, too?
Well, it was actually the Institute of Machine and Industrial Design from which we received the only financial help in season 2016. Although we are much grateful for being given a chance of working on

such an attractive project in our institute, it is clear that its funding resources are limited and, therefore, we are going to do a special promotion getting ready to address potential partners among industrial and other companies. In the past, we cooperated, for example, with HVCC, Kovopressing, Cais, Cressto, B+B Smartworx, Contra and Alfun. I shouldn't forget mentioning that we also receive a major support from the Dean's office and the headquarters of BUT. ■

One year later in May 2017, the BUT Pneumobil Racing Team Brno marked its first major international success in Eger, Hungary. For the first time, its Javelin vehicle ended up among the first ten racing teams in a fierce competition of 38 university teams from six countries. This is really great considering that the Brno team, which was among the first ten in all events, was the only one from the Czech Republic.

DOCTORAL STUDENT

I wish I could have stayed in Berkeley

says a BUT doctoral student after returning from a Fulbright exchange program

Jana Novotná
Photos from Hana Bortlová's archive

Hana Bortlová, a doctoral student at the BUT Faculty of Business and Management, is among those who like to travel abroad for new knowledge and experiences. Right now, her biggest experience has been a stay at University of California in Berkeley as part of a Fulbright program financed by the Czech and U.S. governments. There, she focused on behavioural economics – a subject little known in the Czech Republic.

For a Fulbright program, you need to personally apply. How did you actually get the idea?
I'd always wanted to stay in the U.S. for some time. I started to take interest in Fulbright after I'd enrolled in a Ph.D. programme. I finished a Master study, received a Joint Master Degree in Nottingham and found a job in a Brussels-based incubator because I was interested in problems of start-up financing. After graduation, I brought one start-up to the Czech Republic and started to focus on behavioural economics. No courses on this subject were offered by Czech universities at that time and, gradually, I became convinced that Berkeley was the place to be. It was not easy to get there, though, since there'd been no previous relations between BUT and the university in Berkley and, moreover, being not a graduated Ph.D. student, I was not eligible for admission. Well, but finally, my luck turned for the better and, by September 2014, I was on my way to Berkeley.

Did you learn later on, what helped your luck?
I addressed directly the teachers specialising in the subject asking them for help and, later on, working with them. I got most of the assistance from Professor Terrance Odean, who later told me that it was because he liked my ideas and because he'd never supervised a Czech student hearing that we're lagging behind on economics. One of the reasons was also the fact that, there being lots of Asian students, he wanted to give a chance to a European, too.

Could you give us a short account of what behavioural economics is about?
I first learnt about behavioural economics when reading research papers by Dan Ariely, an American with Israeli background, who is concerned

with irrational decisions in economy and life as such. As I wanted to do research in this field to apply the outcomes to start-ups, I got hooked. Behavioural economics is a multi-disciplinary science that involves economics, psychology and sociology focusing on the user decision motivations. Ariely, for instance, describes a case of a real-estate agency offering two houses and, when a customer cannot make a decision, offering a third one to help the customer get things sorted out so that, in the end, chooses one of the first two houses. Although behavioural economics is used in many areas, it receives very little attention in the Czech Republic.

Did you yourself have a chance to use what you learned in the field?
Well, I was concerned with start-up investment ,– why people invest in a particular business project. There are diverse factors at work here analysed by psycho tests with people divided into 16 psychological types. I'd known something about psychology from my bachelor study of special pedagogy so I did have some background to go on.
I spent 9 months at Berkeley and, had it been possible, I would have stayed longer.

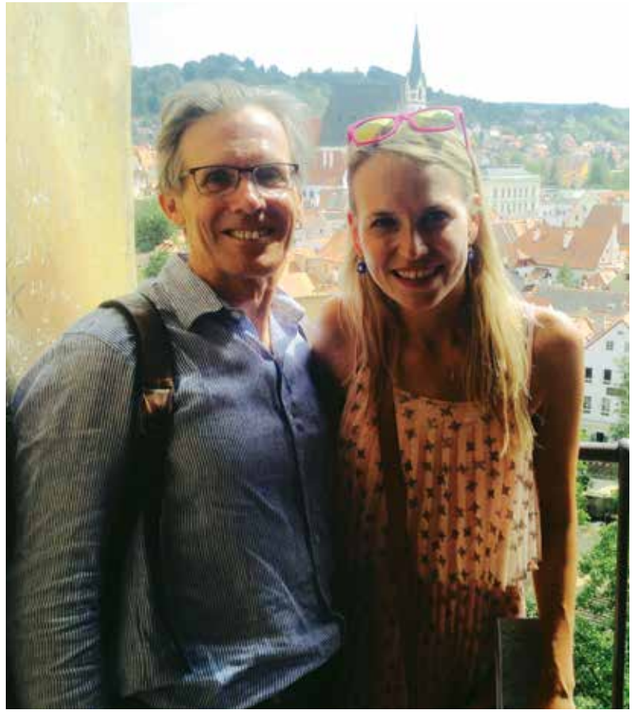
What did you find the most interesting at the university?
I admired the university's Ph.D. study design. The first three years, students just go to school not working on any particular project, starting to do research and writing a dissertation in the two years that follow. While doing this, they may assist teachers while receiving a strong financial support as well as support from teachers in classes. Comparing this to what goes on at our faculty, we were urged to write scientific papers, which collided with our extensive teaching loads and sometimes with our part-time jobs, which was my case.
Later, I was lucky to get a home-office job, but still it was not easy. Well, things may have changed for the better, who knows ...

Did you have any problems with American English?
No, no problems at all. After high school, I took intensive English and French courses at a language school and, at BUT, I started to work for BEST organisation right away, being in charge of Central Europe as a trainer so I came across a spectrum of different accents. The English you can hear in California is very nice and, moreover, passing a TOEFL was a prerequisite for the Fulbright application.
I don't think that I have a flair for languages, but I have no problem talking to foreigners. What was worse for me, however, was econometrics with all those statistical data processing methods full of formulas and equations.

Did your stay at Berkeley result in any particular outcome?
I had to take exams at the university, even though ungraded, I had to write a paper and present it at a conference in Pittsburgh. The outcome for the Fulbright committee was my paper published by the journal Trend. I would like to initiate the creation of a behavioural economics study field at the Faculty of Business and Management. Since it has very efficient applications, it is likely to gain support. I would like to participate in writing the teaching materials.

How do you see your future? Would you like to teach?
Yes, I would but I would prefer a part-time job, if possible, abroad. But, most of all, I would like to do research at a company. This, in my opinion, is much more important than just staying in the academic sphere, since such research is related to practical problems.

What are you concerned with right now? Are you still working with start-ups?
Yes. In Brno, I am helping to start a mobile and web application subsidiary for American customers. I have passed the state exams and am writing a dissertation. Most of all, I would prefer staying in Berkeley, but I must work at least two years with the institution that sent me to the Fulbright, which is one of the conditions of the program. Well, that's a pity because the contacts you make during those 9 months will fade away quickly. I was in Berkeley in the spring of 2016 to attend a one-month course but that doesn't mean a thing. I have been in contact with Professor Odean, he visited Brno several times when lecturing in Vienna



and, thanks to this, he has already improved his original judgement on this country.

The different ways Czechs and Americans think must surely be reflected in your work, too ...
Oh, yes. The American investors speak more freely and openly even admitting their own mistakes so meeting them is very pleasant and simple. The Czech ones, on the other hand, seem to radiate mistrust towards you and all their neighbourhood, showing negativism. It's clear that this is a consequence of the previous long years spent in totalitarian regime and we're still up to a hard task getting rid of this. I also feel this difference concerning the current migration wave. The Americans show respect and understanding to migrants since they themselves are actually migrants, too, whereas people here are afraid of strangers and this is also true for the young generation. For the new Brno based subsidiary, for example, we need experts who have to fit a certain culture type, which is not easy at all. This is even more difficult for the young people who are not accustomed to free communication and thus failing to meet the criteria.

What has the stay meant for you?
Those nine months have given me an awful lot of things - concerning education and life in general. I have discovered the good things about life in my home country realising how safe a place the Czech Republic is. There are big differences, on the other hand, comparing the student-teacher relationships here and in the U.S. In America, the relationship is open, friendly, tolerant and based on cooperation whereas here everybody keeps the new knowledge for themselves. I particularly realised this when offered a bike for commuting by a professor at Berkeley, who knew how much I would have had to pay for public transport and how little money I had. The scholarship I received from the Fulbright commission was hardly sufficient to cover the cost of living in California so I had to draw on my and my parents' savings heavily.

In your opinion, why do students show so little interest in studying abroad today?
I myself urge students to travel, but I have a feeling that they rather consider this a nuisance. They prefer taking part-time jobs while studying, which is easy nowadays, to earn some extra money. When I was a student, getting a part-time or home-office job was a problem while today there are plenty and they are happy to make use of it. Today, bachelor students own cars, live in rented apartments, and often have stable partners, which is hardly a research stimulating situation. I have a feeling that they have sort of embarked upon adult lives.

What is your situation in this respect?
I have a very tolerant and understanding partner. In addition, my colleagues from Berkeley keep me up to date with new findings. I could return to do research at Berkeley; there is a special visa for this. I am much tempted by this idea ... ■

AWARD

Werner von Siemens Award for a BUT doctoral student

Tomáš Pikálek, a doctoral student at the BUT Faculty of Mechanical Engineering and worker at the Institute of Scientific Instruments of the Czech Academy of Sciences, received the prestigious Werner von Siemens Award in 2016. In his master's degree project, he had presented an entirely new method of measuring the refractive index of air.

Thanks to his project, Analysis and Verification of the Method of Measuring the Refraction Index of Air, the measuring procedures using a laser beam, mostly in industry, will be much more precise. Similar technologies are needed, among others, for machining tools, too. The new method has already attracted the attention of opticians, who have selected it for the journal Applied Optics published by the U.S. Optical Society.

"I started to work on the project immediately after defending my bachelor's degree project. Except for a short pause, when I was staying at a university abroad, I worked on the new method for almost all of my master's degree study. Added up, I have spent almost three months in the laboratory. The new method did take a lot of time to test if it really works," described Tomáš Pikálek his way to success.

(ed)

Petr Jambor's Palimpsest will give the reader food for thought

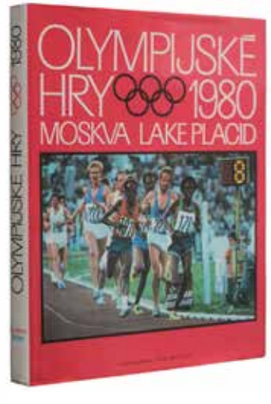
Although only existing in seven copies, the book Palimpsest by Petr Jambor has its own ISBN and has received the Best Book of 2015 Award in the Bibliophilia and Artist's Books category. The author has created the book as his bachelor's project at the BUT Faculty of Fine Arts in the Drawing and Graphic Studio led by Svätopluk Mikyta and Šárka Svobodová.

Jana Novotná
Photos by Petr Jambor

It was when appraising Jambor's Palimpsest that the jury reached an otherwise rare consensus marking the project as "the deconstruction of a book", but most of all as "formally disarming gesture bordering on mystification or even technological mystery". The jury's appraisal goes on: "Referring to old palimpsests with the original text erased so they can be reused, the author actually does not add any new text letting his 'reader' be faced with blank pages with only lonely frames and clear colour regions. The resulting work visualizes the fading of memory and transience of history." By the jury's final verdict, the work can be regarded as an exceptionally original contribution by an author who "combined the profession of a restorer with the chosen medium and multi-semantic communication".

The author himself says that he has only used half of the ancient palimpsest method. "With the original information removed from the book, no new has been added. The content is to be added by the reader. Thus, an imaginary information vacuum is used for a certain speculative testing of interpretation limits," he explains.

From a layman jury, the project also received a Sold Prize of Lukáš Pollert, who commented on this: "The book nicely demonstrates the real face of top-level sports and the Olympiad". However, the choice of the book that served Petr Jambor as the original material was more or less a random business. "I chanced upon a book, Olympic Games Moscow Lake Placid, in a second-hand bookshop and was captivated by its graphic layout. Particularly by the fact that most of the prints, except those taking up a whole page, were edged with black frames, as places for information. I decided to keep such layouts in the book," says the author of Palimpsest. However, he soon abandoned the idea of replacing the original text by something else. "I rather thought about the way to



modify the original prints. This resulted in only two picture fragments in addition to the original layout being left in the book plus the rankings of athletes in events with the points and times they achieved, that is, the cold facts."

Still, the author appreciates the judgements of both juries. "I see the fact that an Olympic champion, who sold his gold medals to give the money to charity, was a member of the layman jury as a humorous whim of chance," adds the author.

He makes no bones about the technique of deleting, so enigmatic for the jury: "The technological aspect of it all is not poetic let alone mysterious. I just used the C6000 nitro solvent to wash away the offset prints from each page. Considering that one copy of Palimpsest has 320 pages, this surely took quite a lot of tedious manual work even with such a small edition."

The seven copies of the book were published by 4AM Forum for architecture and media. These include five copies distributed among the Czech public libraries so that those interested can borrow the book in Prague, Brno and Olomouc. "The project aimed to redistribute Palimpsest in the library system, which has been achieved due to the publisher's obligation to provide public libraries with five free copies of each new book," explained finally the author of the rewarded publication. ■

In 2017, Petr Jambor's Palimpsest received the gold medal in The Most Beautiful Books of the World competiton.

The BUT Christmas Ball organized by students

Over 3,000 guests arrived at The BUT Christmas Ball, organized by students of the Czech largest technical university. This tradition of a university great ball was renewed last year after seven years' pause. Compared with last year, the number of guests had almost doubled so that the event was held in Central Europe's largest indoor exhibition. The ball took place on 2nd December 2016 in Hall P of the Brno exhibition ground. Over 60 students from BUT's all faculties had helped organize the ball to remind everybody that they study at a great university regardless of the faculties and study fields.

(ed)
Photos by Igor Šefr

Art is a field of science as any other, says Dean of the BUT Faculty of Fine Arts

After years of makeshift arrangement, the beginning of the 2016/2017 autumn semester saw a sophisticated logistic manoeuvre to move the faculty provisional campus from the Údolní and Rybářská Streets to the Údolní Street, which is one of the university's first historic campuses. The two blocks of the former barracks facing the Údolní and Úvoz streets are connected with a one-storey wing designed by architect Miloš Laml originally built for an institute of anatomy and still boasting a well-preserved auditorium. Thanks to their arrangement, the former dissecting rooms provide ample light so needed for the faculty studios. The light needed for the work of young artists in both the literal and loose senses was the subject of our interview with Milan Hauser, dean of the faculty.

Jana Novotná
Photos by Ivars Gravlejs and Igor Šefr

Attempts at moving the faculty have continued for many years. Why was this so urgent?
Well, the decision to split the faculty into two separate buildings proved to be questionable from the very beginning. Having very few opportunities to meet, the students ended up being divided into Rybářská and Údolní blocs. Moreover, both buildings were almost in the state of dilapidation being not renovated due to the anticipated movement. Of course, seeing this during the open days, the parents were hardly inclined to encourage their children to study at the faculty, which was rather demotivating. On top of that, the building in Rybářská Street had some static issues.

Has the moving to a new address provided a cure for all the problems?
For us the most important change is that we are all together at the same campus. In addition, the building has its history and layout and if you can accept these, it will help you accustom yourself to it. It is great that the campus is part of the city life with historical parallels at hand. It is a beautiful building, covered with several period finishings, but we have managed to remove most of them. Given the funding and the building sizes, we have achieved the maximum. There is now a space for metal, wood, lamination and spraying workshops, which has given us a considerable relief. When students were laminating at the old campus, the whole building was filled with the stench of epoxy resin. These are now the customary techniques used by the artists so it is great that our students can enjoy the normal conditions.

What have you gained and what do you appreciate most of all?
In terms of the studio sizes, we are a lot better off, but the improvement is just moderate. The reason is that most of the building is taken up by corridors, which have no practical value but provide the space with sort of a grace. In addition, this is something that we should learn how to be proud of and that sends an important signal to society, too. If somebody has been living in a place for centuries, the message is that they support continuity, intelligence, social responsibility... Even if education and management are the

university's primary concerns, its social and cultural roles should not be neglected and so we must remind society of the values it loses. Preservation of the historical relationships and context is as important as good management even if this is often difficult to explain being not exactly economical.

Do you provide the new premises with new equipment, too?
As part of the OP3V projects, we plan to upgrade the equipment of what we call laboratories, which are actually technological sites dealing with 3D images, sound, print, photography, etc. In view of the fast pace of technology, I would say that we have been successful so far. For the Sculpture 1 studio, which is concerned with 3D technologies, we have bought a new

Social and Cultural roles should not be neglacted and so we must remind society of the values it loses.

3D printer getting among the few faculties that can boast such an advanced level. With the manufacturers of 3D printers, we cooperate on the hardware and software development while the companies listen to our sculptors' preferences.

What is the present position of the Faculty of Fine Arts at Brno University of Technology?
Concerning the faculty's special features, they certainly include the studios of performance, multimedia and intermedia, which have been around from the very beginning. They work with digital technologies and state-of-the-art equipment, forming thus an integral part of fine arts, and it is these fields that substantiate the faculty's existence at a technical university. Of course, there are traditional fields, too, but thanks to the new media, the cooperation with engineering faculties has been increasing offering a huge potential.

In your opinion, does the Faculty of Fine Arts compare with other BUT faculties in terms of its importance?
I believe that art is a field of science like any other and people who say that it is not lack a certain part of education. Today scientists are interested in cooperation with artists believing that they may bring inspiration into their fields, something that the usual thinking patterns would leave undiscovered. I have attended the lectures on cooperation between biologists and civil engineers with artists – this is kind of a stepwise thinking with the usual continuity being changed by an external impetus bringing a new surprising result. An artist can afford to do seemingly crazy things that, when mingling with the usual thought patterns, may bring a fresh look at the reality. This is currently an unusual practice in this country but, in the world, engineering and artistic fields mingle more easily.

What else should be done?
We need to equip the buildings with a navigation system, which is now being worked on by the graphical design students. Well, and one more important thing – beginning in January 2017, we open a FFA Gallery. This is supposed to be a faculty showcase to attract a wider public. ■

Petr Bouchal: I don't want to know the world just from the Internet

At the beginning of the academic year 2016/2017, there was an interesting newsflash. A BUT student, as the first representative of the Czech Republic, was chosen for the jury of a prestigious competition. The student was Petr Bouchal, a fresh graduate from the Faculty of Mechanical Engineering, the competition being a Formula 1 in Schools world championship in Austin. He says that the foreign experience was his biggest asset.

Jana Novotná
Photos from Petr Bouchal's archive

He first went abroad for experience already at the secondary school. As a student of a technical school in Přerov, for the first time, he took part in Formula 1 in Schools. "The teachers told us, we had no chance. Well, this actually stirred us into action. We set up a team, built a car, raised some funding and went for it." They won the regional and national rounds, and soon they went to Singapore. "It was a rare experience! The teachers then told us that what we had learnt over one year in the competition was more than some university students knew. This really pepped me up."

He became a member of student organisation BEST right after enrolment at BUT. He met people who had experiences from all over the world. They told him he could have it, too. "Right after completing the first year, I set out to a camp in the U.S. to work as a maintenance man in a children camp. My eyes opened again. I found my European English to be not good enough seeing that a lot of work must be done. And there was time to think a lot."

After returning home, he is active in BEST again. He prepared European BEST Engineering Competition (EBEC) 2012. In the holiday, he joins his BEST friends travelling to Hong Kong to take part in a best-business-plan competition. Their Car To Work web application was designed to make commuting easier. "Although we didn't win, we could try other skills, presentations, meeting investors." BEST organized a summer school in Helsinki with Petr being among the 22 participants chosen from 600 candidates. Lectures in the mornings, team work in the afternoons, social activities in the evenings.

He went to his first Erasmus to Birmingham in England. This was supposed to be a purely professional choice. "They say that this is the fourth best business school in Britain, an embellishment for every CV. Although the quality of teaching is not the best, team classes are good. Once a week after attending a specialist's lecture, students work in teams. It was intensive and useful. Something like this seems to be missing at our university."

He worked on his bachelor's project on carbon composites seeing this as a promising field of research. He decided to do business in this area. At a lecture in the South Moravian Innovation centre he met Jan Tesař. "In his place, we baked our first product in the oven – a light and firm piece of material. Launching it, we were trying to get an investor, rather than developing the product." And they were nominated for the 2014 Czech Innovation in the Business Potential category.

Then school prevailed again – studying manufacturing technology and industrial management in a master's program at the Faculty of Mechanical Engineering and library science at Masaryk University. "Well, I say to my friends that I enrolled because of the pretty girls, but the curriculum includes online marketing, social media, service design, which all can be used in business."

They organized the first Techfest in BEST. The second Erasmus was a matter of personal liking – Ljubljana. Slovenia has mountains, sea, ... everything. "The school didn´t have the best ratings, but I just wanted to try studying less and enjoying more. I believe that this is what Erasmus is about."

A summer school in Munich followed. From 1,300 people from all over the world, 40 were chosen including Petr. "There I met people who now work at Massachusetts Institute of Technology, at Facebook, LinkedIn and such companies. We are in contact on WhatsApp, keeping everybody up to date..." It was also in Munich where a nappy project was born. Up to 1.2 billion nappies end up in waste everyday. What can be done about that? "At first, we wanted to recycle nappies producing medicaments, but this was too costly." Therefore, they optimized the projects to the Czech circumstances. They engaged a Czech manufacturer of modern cloth nappies offering a home delivery of washed nappies. They launched a presale. A huge media wave followed, but nobody was interested. "The pricing must have been wrong. In the 90 days of the pilot sales, there were only three customers. We needed at least 100 people for the business to pay, so we gave it up."

The year 2016 was Petr's fifth at BUT. He was working on the EBEC again. He went to the Belgrade finals to support the BUT team, which ended up second. "And now the Austin world championship is here. This year I was there for the second time. That's a place where you can meet the world's bosses of F1

> I met Naveen Jain, founder and executive chairman of Moon Express. And also I met Dirk Ahlborn from Hyperloop Transportation Technologies.

teams. It is great feedback for the students and an opportunity to make new contacts." Then the master´s theses was knocking on the door. He designed a 3D printer and a business plan on top of it. He started to communicate with the world's biggest manufacturer of 3D printers and this is what Petr likes. "To design your own 3D printer is actually not so difficult, which is why it is so popular. Another reason is that, while everybody's talking about it, almost nobody can make use of it. The highest level can be found in healthcare. Josef Sedlák from the Faculty of Mechanical Engineering told us, for example, how an artificial joint can be replaced using a scanner and a 3D printer. The convalescence is three times as short."

Petr finished his master's study. He received a degree of MSc. just to satisfy his mother. He went on to study quality and safety at the faculty. "I am not planning anything and keep having ideas." Although his study record was not composed of just A's, he was not doing bad at all. In addition, he found time to write to magazine published for the new BUT students advising them not to shirk anything and go for it.

Petr Bouchal says that, if he did not travel, he would only know the world from the Internet. When travelling, he meets interesting people that he would hardly see at home. "I met Naveen Jain, founder and executive chairman of Moon Express while co-organizing Websummit at Dublin during my studies in England and Dirk Ahlborn from Hyperloop Transportation Technologies when I was in Vienna." This was one of the reasons for organizing Techfest. Techfest – to meet engineers who want to change the world. ■

AWARD

TA ČR Prize for FIT

Believing that they will change the world for the better, the Technological Agency of the Czech Republic gave its support to some research projects. On 20th October 2016 the winner of the Solution Usefulness category was a project to design a speech recognition technology for efficient man-computer communication. Participating on the project was a Speech@FIT team from the BUT Faculty of Information Technology in cooperation with several commercial companies.

The project aims to design advanced methods of speech recognition in practical applications: searching in electronic dictionaries on mobile devices, dictating translated texts, security and defence, dialogue systems, customer care systems (CRM, helpdesk, etc.) and audio-visual approach to teaching materials.

(ed)

Builders could learn a lesson from history, says Pavla Rovnaníková

As an expert on historic facade renderings, Pavla Rovnaníková from the Institute of Chemistry at the BUT Faculty of Civil Engineering participates in many monument reconstruction projects in the Czech Republic. In 1970 she joined the former Department of Chemistry at BUT and has stayed there ever since. She has devoted almost fifty years of her professional life to the development of new building materials and their degradation. Her speciality is surface finishes of historic buildings.

Jana Novotná
Photos by Igor Šefr and from Pavla Rovnaníková's archive

How does it come an eighteen-year-old girl decides for chemistry?
Well, if she has good chemistry teachers at the secondary school... And a friend chemist from the elementary school with whom she can talk about chemistry. In the end, I came to realize that chemistry was a beautiful science. After secondary school, I enrolled for chemistry at Masaryk University in Brno majoring in inorganic chemistry and soon after graduation I started to teach at the BUT Faculty of Civil Engineering working with Jiří Brandštetr. At first, we were concerned with the development of analytic methods for building materials, but in 1975 we focused on the chemistry of building materials, their development and degradation.

When did you start to be interested in historic monuments?
In 1976, we began to cooperate with a building company in Opava, specialized in the remediation of damp masonry. Although only little was known about this problem at that time, this company had made considerable advances. I started to engage in remediation, too, until I came to work on monument reconstruction.

The methods used today are quite different using thin-layer cements, which is not possible with monuments to be reconstructed.

Does monument reconstruction exist as an independent study field?
I do teach in some courses that border on monument reconstruction, but no, there isn't a separate study field. It's a pity as the old technologies are forgotten and the new ones cannot be used to reconstruct monuments. Therefore, I'm searching in old sources to find information on original, in the modern building industry no longer used technologies. The traditional masonry craft is in decline in the Czech Republic. Apprentice schools have been strongly reduced; some apprenticed masons can't even use a trowel, not knowing anything about bricklaying or manual rendering. The methods used today are quite different using thin-layer cements, which is not possible with monuments to be reconstructed. The problem is that the company implementing a reconstruction cannot guarantee using old masonry technologies.

Taking plaster samples in the yard of the Sázava monastery

Can history surprise you or teach you a lesson with its materials and technologies?
You bet! Now, for example, we are surveying a farmyard in Sázava. Using a probe, we discovered a clay damp proofing and found it still functional considering the low moisture content in the footing part of the masonry. Well-processed clay has a low water permeability protecting thus the masonry against moisture from the surrounding soil. In the past, it was customary to use clay damp proofing, but today the technology has been forgotten and attempts to restore it usually fail. In castles, again, our ancestors used diverse ventilating systems, which, if well maintained, still work today. Nowadays, HDPE films are frequently used, which cannot replace the function of ventilation systems. The present builders could learn a lesson from history.

Can you give us an example using a particular construction?
For example the outside lime plaster finish of the Český Krumlov castle. Although 600 years old, it still looks well. The castle's south facade was restored sensitively with only patches of missing plaster added and the rest stabilized with limewater. Lime used to be added to mortar as a binder. Pieces of calcined limestone were slaked to form lime paste, which was left to ripen. The result was hydrogel with which the resulting plaster had a low water content and could be well processed. Crushed bricks rather than cement were added to plasters reacting with the plaster and increasing its mechanical properties and durability. In the past, a pit with slated lime was ready next to every house as there was always something to be repaired or white-washed. Today, maintenance is not given due attendance. A costly repair is made and the house is left unattended until it is in a state of disrepair again with large funding required for a new repair.

Can the modern science, in turn, help save the monuments?
In 1964, a Venice charter was signed stipulating rules for monument reconstruction. It says that, if the original technologies are not known or cannot be used, they can be replaced by modern ones. This is conditioned by perfect verification of such a technology and by the intervention being reversible. In many cases, this condition has been violated. The use of acrylic paints from the beginning of 1970's and

> The outside lime plaster finish of the Český Krumlov castle. Although 600 years old, it still looks well.

repairs of historic buildings with reinforced concrete can be given as two examples. On the other hand, the successfully used modern materials include organic siliceous composites to stabilize and impregnate surface layers. In recent years, nanotechnologies have found numerous successful applications to monuments such as in cleaning finishes and consolidating materials. So, yes, new technologies can be used to advantage, but always any chance of damage to the monument must be eliminated.

Speaking about inexpert interventions, surely, the massive use of concrete in repairing the Veveří castle was one. Ironically, in time when the castle was managed by BUT.
Parts of the castle which were used as BUT stately rooms, were repaired with ferroconcrete at that time. Well this was a decision made by the static analyst, who was responsible for the construction not to break down. Today the repair would be done using a gentler method.

Is there any favourite monument of yours, in whose saving you participated?
Since I know a lot about plasters and mortars on historic buildings, I work on the reconstruction of a number of monuments. Ruins are among my favourites. I participated in the restoration of many of them such as the Cimburk castle near Koryčany, Lietavský castle in Slovakia, and the Zlenice castle. Ruins are not repaired, only the masonry that has remained is fixed to stop further degradation to make them safe for the visitors. I analysed the historic mortars of historic buildings before to devise formulas for repair mortars, which must exactly copy the composition and properties of the original ones.

How many experts like you work in the Czech Republic?
Well, I don´t know, but there might be a few. I am often asked by preservationists, designers and building companies to analyse plasters and mortars. For more than twenty years, I have worked on a committee of Society for Monument Protection Technologies organising seminars on monument protection with invited lectures by experts from various fields and issuing a Bulletin. The events are intended for preservationists, authorities making binding statements concerning monument protection and for companies implementing the protection. The seminars are much in demand.

You are the leader of a number of research projects. How often do the outcomes of the projects find practical applications?
I have led 23 projects so far. Currently, I am one of the solution providers to a project of applied research and development of national and cultural identity concerned with the architecture of 1960's and 1970's, which is worked on by a consortium headed by the National Heritage Institute. The members of the consortium also include Czech Technical University in Prague (CTU) and Institute of Theoretic and Applied Mechanics of Academy of Sciences of the Czech Republic. This project and its outcomes are different from that of the projects of the Ministry of Industry and Trade or Grant Agency of the Czech Republic (GA CR). While the GA CR projects are focused on basic research, those of the Ministry of Industry and Trade require outcomes with practical applications in civil engineering. In the last project, for instance, we created one utility pattern and took out one patent.

You have mentioned cooperation with CTU...
Yes, it started in 1997 when we applied for a grant shared with Robert Černý from the Prague faculty of civil engineering. Now we have already provided solutions to 14 projects. Our research team works on the development of new materials while our colleagues at CTU are concerned with the physical parameters and transport effects on the developed materials so we complement each other presenting our results in a number of quality research papers.

You are a teacher and author of textbooks. Do you enjoy teaching?
Yes, I do. When talking about the theory, I include a lot of practical examples. I teach building chemistry in a first-year bachelor's course and give lectures on the chemistry of building materials and ecology in the building industry for master's students.

While pursuing a scientific career, you have brought up two children when running a household... How did you manage that? Do you think that, today, women have better opportunities for work life balance?
Certainly, the times have changed. Women get support for work life balance, getting part-time or home-office jobs. They can use modern technologies for cleaning or shopping, etc. What is essential, the partners have to agree on sharing roles and bringing up children so the woman have some space for pursuing her professional career. The old pattern of the husband earning money while the wife takes care of the household seems to be outdated. At the time when I was bringing up the children, there were no such conveniences, but things could be managed, thanks to hard work and the tolerance of my partner. ■

Society for Monument Protection Technologies was established in 1994 as an association of professionals concerned with the issues of monument protection. It aims to improve communication between preservationists, engineers and restorers, and better inform experts on the current issues in organizing seminars with invited speakers from different professions, publishing research papers as well as conclusions, recommendations and opinions from its expert meetings.

Who is Prof. Dr. Pavla Rovnaníková, PhD.?

She was born in Pilsen.

In 1970 she graduated from the Faculty of Science at Masaryk University in Brno entering into employment at the BUT Faculty of Civil Engineering. In 1981, she defended a dissertation on building materials and non-ferrous materials.

After successful viva voce in 1992 she was appointed associate professor and in 2004, she received a professor tenure in physical and building materials engineering at the BUT Faculty of Civil Engineering.

Since the mid 1990's, she has been the leader of research team working on over 20 projects in building materials engineering focusing on silicate materials.

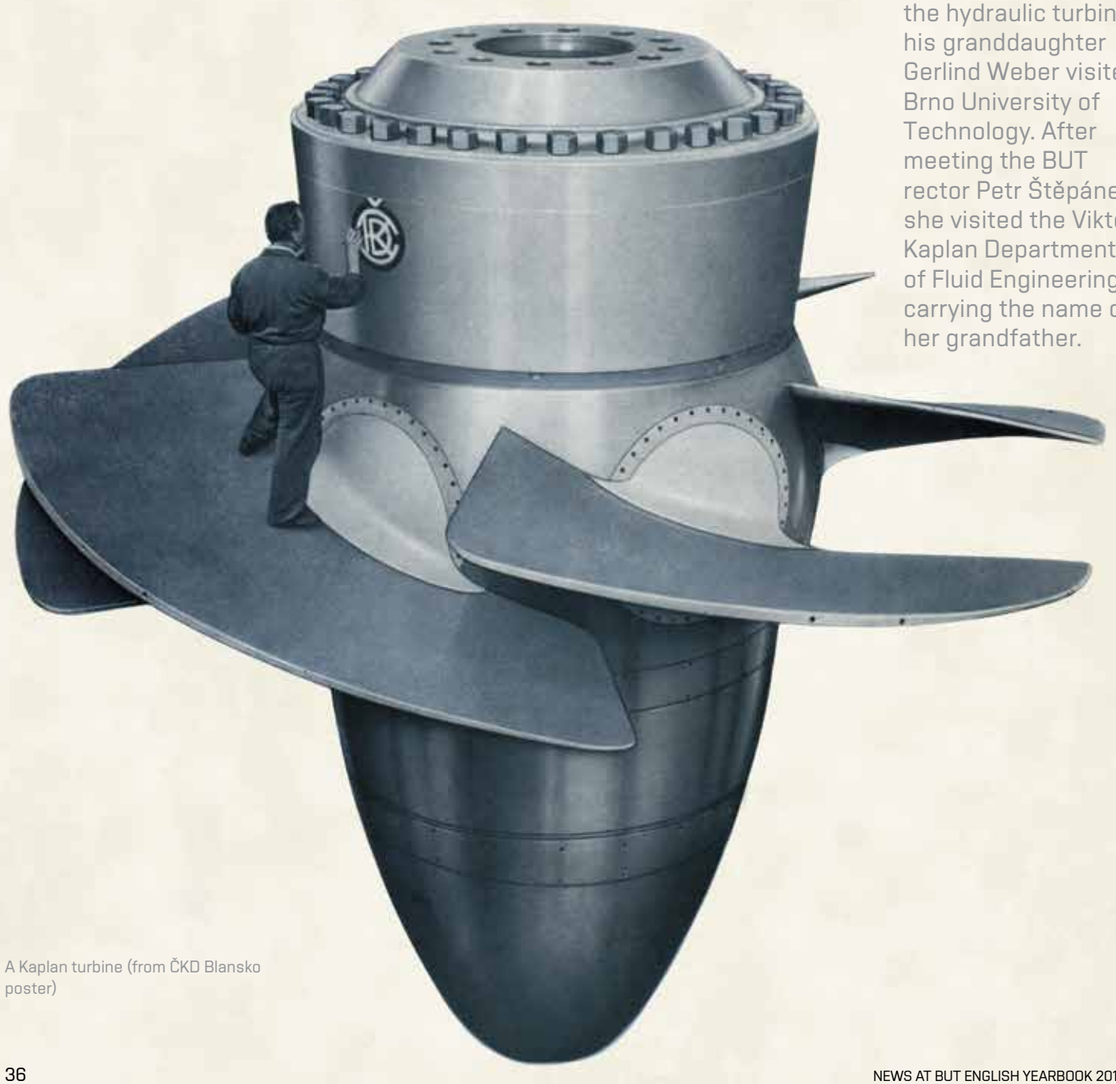
At present she also works for the AdMaS research center.

We celebrate Viktor Kaplan's 140th anniversary.

He came up with his greatest inventions in Brno

Jana Škrdlíková, BUT Archives and (ed)
Photos by Igor Šefr and from BUT Archives

On the eve of this year's 140th anniversary of Viktor Kaplan, the inventor of the hydraulic turbine, his granddaughter Gerlind Weber visited Brno University of Technology. After meeting the BUT rector Petr Štěpánek, she visited the Viktor Kaplan Department of Fluid Engineering carrying the name of her grandfather.



A Kaplan turbine (from ČKD Blansko poster)

Viktor Kaplan as a designer in Brno in 1909

Viktor Gustav Franz Kaplan was born on 27th November 1876 in Mürzzuschlag, Austria, to Carl and Jenna. He went to a Volksschule in Neuberg an der Mürz and then to Walter's Realgymnasium in Vienna where he showed a talent in science classes. It was, therefore, natural that he should enrol at the Technical University of Vienna to study mechanical engineering. However, learning was not the only activity he was involved in – he established a card club, he was playing tennis, skating, biking and hiking in the mountains. In 1900, he graduated as a mechanical engineer. After having done a one-year national military service in 1901 he entered an employment with Ganz, a Leobersdorf based engineering company manufacturing diesel engines. Here, he designed and patented a new type of engine. The diesel fuel is injected into the cylinder immediately after the compressed gas is ignited. In 1903, he held a lecture to the Association of Austrian Engineers and Architects on fuel-injection engines.

In the same year on the recommendation of Professor Alfréd Musil, the young Kaplan was granted tenure at Department of Mechanical Engineering and Kinematics at the German Technical University in Brno. His research at this department focused on efficient use of the waterpower. Invented in 1868, the Francis turbine was among those used at that time. Kaplan was making improvements on it and, as he had no testing laboratory at first, he conducted experiments with air rather than water. His paper, Design of rational runners of Francis turbines, was accepted as a dissertation at the Technical University of Vienna, for which Kaplan, at the age of thirty, received a degree of "doctor of technical sciences" in the spring of 1909. In the same year, he qualified as a lecturer at the German Technical University in Brno. In 1913, he was granted tenure as an extraordinary professor of water turbine and head of the department becoming a regular professor in 1918.

> Kaplan patented the first version of the new water engine type in 1912.

Kaplan patented the first version of the new water engine type in 1912 after he had succeeded in making a major theoretical advancement concerning the adjustment of the runner blades. After that, these could be adjusted while the turbine was in operation so that their tilt was optimal for the current water quantity entering the turbine. If enhanced in this way, a turbine can work with high constant efficiency even if the water flow is low. This was the birth of Kaplan turbine! Professor Kaplan patented his main inventions from 1912 to 1914: the turbine radial guide-wheel with predominantly axial action wheel, the feathering design of turbine blades, the layout of the large bladeless space between the guide-wheel and the blade-wheel and the non-cellular design of turbine blades.

The WWI and the patent bureaucratic disputes postponed the use of Kaplan's inventions until 1918 when the Brno machine and foundry works owned by Ignác Storek manufactured the first Kaplan turbine for a spinning mill in Velm (Lower Austria). Receiving much credit from the experts, the turbine proved to be powerful beyond expectation. Based on the judgement of the Reich Court in Leipzig, Professor Kaplan took out 280 patents in 27 countries. In 1926, he was conferred an honorary doctorate by the German Technical University in Prague and, six years later, by the German Technical University in Brno.

> My grandfather was also a practical person and a family man. He was witty, owning a farm on which he worked, says Kaplan's granddaughter.

In 1909, Viktor Kaplan married Margarethe Strasser, the daughter of a cloth merchant in Vienna. In one year, their daughter Greta was born followed by Gertraud three years afterwards. The work strain and protracted struggles for the recognition of his inventions had taken their toll on Kaplan's health leading to a chronic neural disease in early 1922. In 1931, he asked for an early retirement moving with his family to a homestead in Rochuspoint in the Salzkammergut of Upper Austria. Here Viktor Kaplan died on 23rd August 1934 aged 58 years.

Gerlind Weber with the BUT rector in front of a bust of Viktor Kaplan

"Apart from being intelligent and talented, my grandfather was also a practical person and a family man. He was witty, owning a farm on which he worked," says Gerlind Weber reminiscing about the famous inventor. She teaches at the Vienna University specializing in land farming and country development. During her visit to Brno, she visited the campus at Údolní 53, one of the first of Brno University of Technology. A bust of Viktor Kaplan in front of the campus reminds us of the place where he used to give his lectures.

Pavel Rudolf, head of the Viktor Kaplan Department of Fluid Engineering, who escorted Kaplan's granddaughter all day, said: "To me, Viktor Kaplan is the greatest inventor connected to Brno. Our department deals with hydraulic machines while he worked on turbines, that's a direct link. We are proud that his family allowed us to use his name."

Welcoming Gerlind Weber to the Faculty of Mechanical Engineering, František Pochylý reminded her that there were still objects at the department with which Viktor Kaplan had worked. It is, for instance, a glass suction duct, which he let Kaplan's granddaughter hold in her hand while she remarked: "Well, this was held by Viktor Kaplan! There may still be his fingerprints." ■

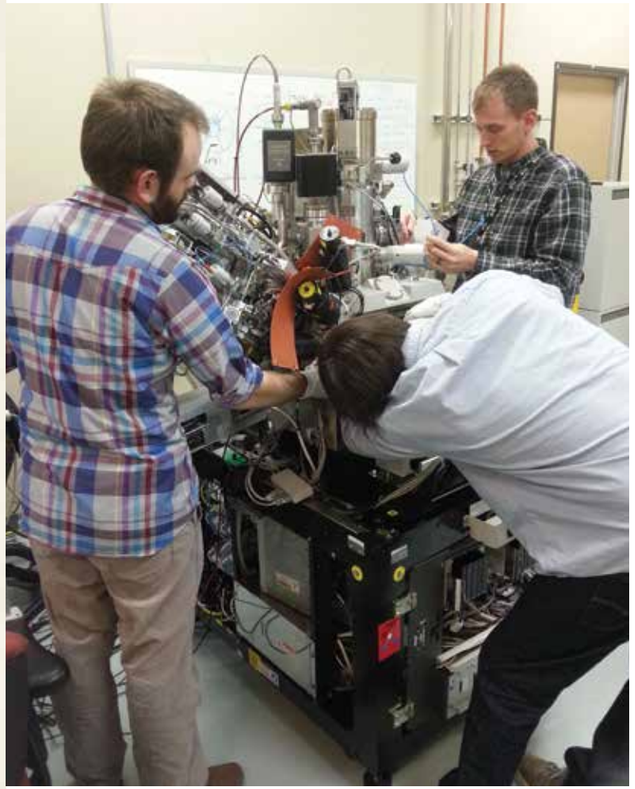
The bust of Viktor Kaplan in Brno
The sculptor of the bronze life-size bust of Viktor Kaplan is Sylva Lacinová-Jílková. It is placed on a hexagonal polished granite base with the inscription: "Prof. Dr. MSc. Victor Kaplan worked in Brno from 1903 to 1931 designing here his Kaplan turbine." In 1959, the bust was placed at the crossroads of Údolní and Úvoz streets, near the place where Viktor Kaplan lived and taught.

An Austrian banknote with Viktor Kaplan
"Dear granny, could you please send me a grandfather?" This phrase appears in many letters addressed to Mrs Margarethe Kaplan in the 1960's and early 1970's. With a deep sigh, the elderly lady put a banknote in the envelope accompanied by an affectionate encouraging letter sending it to the place where her grandchildren studied. Of course, all this could happen because, from 1962 to 1972, Austria did the utmost honour to this great intentor by printing his portrait and name on the one-thousand-Schilling banknote.

GRADUATE

I can work anywhere, says Pavel Šafář, the FEEC graduate

Research and development in electron microscopy has existed for almost 70 years in Brno. Until recently, the biggest manufacturer of electron microscopes the FEI Company, FEI Company amalgameted last autumn with Thermo Fisher Scientific, world's leading supplier of products for research laboratories and centres. One of its experienced employees is Pavel Šafář, an automation student and graduate from the BUT Faculty of Electrical Engineering and Communication (FEEC). Admitting that he has never been an A level student or giving much thought to his future career, today he has a clear idea.



Jana Novotná
Photos archive of Pavel Šafář

How did you get to FEI?
They have a well-functioning system of employee reference. A friend of mine who knew me from a previous employment vouched for me and I was accepted.

What positions have you had at FEI?
Well, I actually skipped the obvious introductory training cycle, starting in the microscope-finalizing workshop right away. After some time, my future boss asked me if I wished to work on the most sophisticated microscopes in Brno, I said yes and stayed with it for four-and-a-half years. Then, a position was integrated in the service department and, as my English was quite good, it was an easy choice for me. The bulk of our services consisted in providing remote technical support – communicating with the customers by phone and e-mail, but there was a more interesting part of it, too, requiring us to visit our customers all over the world.

What are the specific features of the FEI products and what pitfalls are there for an uninstructed customer?
Electron microscopes are very sophisticated devices in which you will find everything from physics to chemistry and electronics. So, wide understanding is required, but being good at physics and electrical engineering does not necessarily make one a good manufacturer of electron microscopes, the problems are very specific. As far as customers are concerned, most of them work in the semiconductor industry so most of my service trips were of this type. It is typical of the semiconductor-industry customers that they always want to get the maximum out

of the microscopes, which poses a risk of overloading and other problems that a service department has to deal with.

What places have you been to as a service engineer?
The first trip abroad was to China. Since I'd never traveled by plane before, it was my first experience of this kind and it was great. I was happy to go to China, I went directly to Beijing where I spent a week finding a solution to a long-unresolved problem and, finally, I felt pretty confident about my abilities. Another destination was Korea, which I have visited three times spending a total of six months there. You see, this is time long enough to make friends and learn a lot about the culture which is pleasant. In Asia, there was one more visit to Singapore and then I headed to America. I have made about five trips there usually for a week or two, working on a problem during two visits while on the other trips I went to service sites such as the Hilsboro branch where some innovations had been transferred.

In the countries that you visit, are there any service centres with which you can cooperate when dealing with a problem?
We have three service centres, in Europe, America and Asia, and there are local service engineers in each country. Before visiting a customer in Asia, you have to ask a local service technician to accompany you; otherwise, you are up against a rather sophisticated environment. In Korea, for example, the problem is that there are lots of new employees with very little experience so Brno people go to Korea to organize two-month training courses. If a customer has a problem, they contact the closest service engineer and, if this doesn't help, they turn to the local service centre. If not even there a solution is found, we step in as a last chance. Some trips are necessary to let the customers know we care about them. Wherever I came and could speak with the customers – in Korea and China assisted by the local engineers – they were fully satisfied.

Did you always make use of English?
Yes, I don't speak any other language. All the employees and customers do speak English of a kind and, very quickly, you get used to different accents. And then, once you start talking business, everything is much easier.

What was the most difficult case you have had to deal with and what was your biggest success?
Perhaps the first two months in Korea I enjoyed the most. It was at the time when our systems migrated to a new Windows release, which required new software, too. As I said, Asian customers will try to get the maximum out of a microscope, which is not exactly good for the software. It was in one of the world's biggest electronics factory, the problems had lasted for quite a time and, since I'm not much of a software developer being in charge of technical support so this was not my specialization. Thanks to communication with the customer and the local colleagues, I managed to resolve the software problems within the two months. The customer OK'ed this and I could leave feeling great. Otherwise, dealing with a microscope, I prefer the technical side of it, stripping down and assembling.

Do you bring any equipment of your own?
Not really. I just get on the airplane assuming that I'll find everything at the site. Of course, if I know beforehand that a very specific part will be needed, I take it along. Sometimes it does happen that a particular service warehouse does not provide all that is needed and then it is necessary to look for it in a different one of our worldwide network. In most cases, it works. In terms of logistics, the company is well organised.

Apart from your work, what has been your most interesting travelling experience?
My last trip before Christmas of 2016 was to California. While in the Czech Republic the temperatures were about zero, there we had an amazing eighteen above and that was my best trip. I like nature and rock climbing, too, so I went to Yosemite National Park and then travelled all over California in a car. When on a business trip, we may take a leave to stay longer so I made use of this.

Have you experienced any cultural shocks?
The biggest shock was China and the omnipresent spirit of communism, that was a strange feeling. You enter the underground through a metal detector with armed guards everywhere, you are under constant surveillance. This was even worse in Singapore, which is basically just a city and a port. I was surprised to see there how everybody is continually monitored. Each car has a little built-in box tracing the car's movements, which is mainly for charging toll on highways, but a local service guy told me that a next generation is able to monitor everything. The crime is very low there, with cameras everywhere, nobody will take chances. But what surprised me the most is that everybody seems to be OK with this and nobody is protesting.

Is your position still a service engineer?
Well I've just decided to change it. I'm going to work at a training centre that has recently been opened so there'll be no more trips. The centre is designed for service engineers from all over the world, mostly from Asia. The poor little guys have a hard life there. A newly employed engineer must be able to service a customer's microscope already within three months. Well, I can hardly imagine that. A microscope may take as long as six weeks to manufacture and, before I started servicing on my own, I did the first two or three devices with someone I could ask about anything, always getting an answer. There is no such a thing in Asia; after a couple of months, they have to be in full deployment and under stress on the customer's site.

Can you stay with a company like FEI for all your working life?
I would say yes. Now that FEI is part of Thermo Fisher Scientific, there are about a thousand opportunities opening for us all over the world. The system has been here before – you can find a company accepting service engineers, show interest in the position wherever it is, say in Alaska. A lot of my friends have already made this option so I'm not resisting any change. I believe that everything is still ahead of me. ■

COOPERATION

FIT will cooperate with Facebook

The BUT Faculty of Information Technology and representatives from Czech Technical University in Prague will be included in Facebook Artificial Intelligence Research (FAIR). Facebook wil provide both universities with high-performance servers to speed up the calculations.

"Facebook is not just a nice application, but also a company conducting the world's leading research into machine learning and artificial intelligence. With the servers, we can increase the computing power giving our research groups tools to carry out computations requiring huge amounts of data such as those relating to speech, image and video processing, data mining and knowledge representation, computer graphics and computer photography," said Jan Černocký, head of the Department of Computer Graphics and Multimedia.

The FAIR programme aims to accelerate the artificial intelligence research with Facebook providing 22 high-performance servers with GPU computing accelerators for 15 most important research groups in 9 European countries. Representatives from Facebook will help the research groups launch the servers, install the required software and they will also take part in the research itself.

(red)

Leader of the new NETME Centre project: Research is a bit like genetics

After three decades spent at universities abroad, Jiří Klemeš, a renowned sustainable development researcher returned home to the Czech Republic. At the NETME Centre of the BUT Faculty of Mechanical Engineering, he will be the head of the project Sustainable Process Integration Laboratory (SPIL).

Radka Šťávová, NETME Centre, BUT FME
Photos by Igor Šefr and from Jiří Klemeš's archive

Professor Klemeš, you came to BUT to manage a project receiving support from the Research, Development, and Education operative programme. What is the main purpose of the project?
Our research is a response to the alarming values of greenhouse gases and the urge to cut down greenhouse gases and other emissions. We all feel their harmful effects especially in winter. The project's main objective is to make unique and applicable findings to help improve the efficiency of the process and power industry. I would like to point out that the project has been well prepared by highly qualified researchers from the NETME Centre.

Why, after the years spent at universities in the United Kingdom, but also in Hungary and China, have you decided to do your research in the Czech Republic?
Well, I feel this as my duty. I returned to Brno at the end of my research career wanting my name to attract top researchers from abroad. I also hope that I will help promote NETME Centre and the Faculty of Mechanical Engineering abroad and recruit international students. I will also represent the university while travelling abroad – I plan to give plenary lectures at Cornell University, which belongs among the ten Ivy League American universities and to attend a PRES international conference I initiated in Prague twenty years ago to name just a few. Over that period, it has become an event of worldwide reputation. In 2017, the conference takes place in Tianjin, China, with 500 papers already submitted.

Can you describe the international team working on the project?
Well, at the beginning, the group will not be as big as the one we had in Manchester, but remarkable and promising persons are appearing. Petar Varbanov was my PhD. student at University of Manchester, Institute of Science and Technology, we both worked at Tyndall Centre for Research in the Climate Change. Next, there are Timothy Walmsley from New Zealand and Andreja Nemét, a Slovenian girl with Hungarian background, who received two doctorates at two European universities and also an intership in Soul. The team will also be joined by young doctoral students from Malaysia and China. There should be nine researchers from abroad in the team.

Why is it so important for the team to have people from abroad?
Research is a bit like genetics. Inbreeding often results in decreased vigour of the offspring, you have to bring in some new blood. Therefore, I am glad that the research team of the institutes of power and process engineering is complemented

Jiří Klemeš receives an honorary doctorate from Johor Raji Zarith Sofia, queen of Malaysia and chancellor of Universiti Teknologi Malaysia.

by scientists from New Zealand, Bulgaria, Slovenia and China. Young researchers are a precious asset. In my opinion, researchers below 40 have a better chance of discovering something new. For this, they need optimal conditions and maximum support. An older researcher, on the other hand, can offer a wealth of experience motivating and guiding the youth.

How does such a multinational team work?
Just one practical example. The Manchester research centre, called Centre for Process Integration, consisted of 36 nationalities, which was the objective. On recruitment, the country of origin was always taken into consideration. Each research team have their own objective, point of view, contacts, previous experience and mentality. In Manchester, our team was dubbed "small United Nations". Speaking from my own experience, it works very well.

So the benefits are of both scientific and social...
No doubt about that. I like to think back to the National Dinner we organized in Manchester. Everybody cooked his or her national meal offering it for tasting. Paradoxically, the biggest problems experienced the British as the British cuisine is not exactly popular. Their typical meal is Yorkshire pudding or fish and chips wrapped in an old paper. Otherwise, it was beautiful; we tried most diverse Arab, Indian, Chinese and Vietnamese tastes. After such an event, every team works much better and in harmony.

Do you think that BUT has the potential to attract students from abroad?
BUT and, particularly its Faculty of Mechanical Engineering, which I know best, has a remarkable tradition, outstanding teachers and talented students. Nevertheless, today, there is a fierce competition in university education and, more so, research. Not even such countries as USA and United Kingdom could do without addressing the best doctoral students. We can capitalize on the fact that today's students seek strong personalities. Picking a Professor to learn from used to be typical in medicine but, in today's world, such a tendency can be observed in engineering too. Having a good and renowned supervisor makes the embarking on a scientific career easier and more likely to succeed.

So what does your international team mean for NETME Centre and BUT?
The presentations of research abroad will help promote BUT on an international scale and attract more scientists and students. I hope that our starting laboratory will play its part, too. Top scientists from abroad should not give rise to concerns – on the contrary, they are people from whom we can learn a great deal. I would like this to be regarded as a challenge. ■

Sustainable Process Integration Laboratory (SPIL)

A project implemented by an international team headed by Professor Jiří Klemeš from NETME Centre at the BUT Faculty of Mechanical Engineering. This is the only BUT team to be included in the group of 32 teams of excellence supported by the Ministry of Education or by EU. The project is funded from the Research, Development and Education operative programme. Launched on 1st February 2017, the project will last for five years.

SPIL reacts on the alarming values of the greenhouse gases focusing on minimizing the greenhouse, nitrogen, energetic and water footprints, on cutting down smog producing emissions, and on comprehensive solutions to power and water saving.
The project aims to build a competitive international research site and reveal applicable findings to help improve the efficiency of the process and power industry mainly by minimizing the greenhouse, nitrogen, energetic and water footprint.

Mountains make me feel like running, says uphill runner Michaela Stránská

Enrolling at BUT in September 2016, already in December, Michaela Stránská received a BUT Best Athlete 2016 Award. Having collected so many major prizes in the past season as a junior uphill runner, she is definitely worthy of this title. "In case I'm not picking up the phone, I may be running somewhere," she said when we were arranging this interview. Running, that's all her life. Or almost all, as now she spends a lot of time at the Faculty of Electrical Engineering and Communication (FEEC) studying English in electrical engineering and computer science.

Jana Novotná
Photos from Michaela Stránská's archive

How did you come to decide for an engineering study at FEEC?
I wanted to go for humanities at first, but then I chose engineering instead because of better jobs being offered to the graduates. Another thing is that I enjoy studying foreign languages and this field offered both.

How do you see+ your future after graduation?
Well, being a freshman, I still have a lot of time for this, but actually, I'd love to work as a sales rep with a company manufacturing products of my field.

Did you notice the new "I Belong Here" promotion campaign of BUT?
Yes, I've seen a video on Facebook, very nice. Of course, there are more boys than girls at the faculty, but I don't mind, it does have some benefits, too. Say, we meet at a door; I'm offered to go first. Now, that's certainly agreeable.

How do you manage to do top level sport and study at the same time? I know this is an obvious question, but I mean, in spite of time shortage, it may go together well – sitting at school and then working out.
It certainly does. After sitting at school the whole day, I can't wait to get on the track. It cleans my head, being a meditation as it were, thinking of nothing just running along.

Could you tell us something about uphill running, the event you specialise in?
Well my speciality is actually off-track running. This includes both road and cross country running. Uphill running is more cross-country but there are a few road competitions, too. Starting at point A, a track leads to point B, which is usually the top of a hill so that you go up the hill all the time. There are up-and-down tracks, too, which means that you finish running down the hill. This is even more difficult. Both climbing and going down are technically demanding, you must keep watching your steps.

How long is an uphill track?
This is different depending on the category. This year I'm passing to the women. As a junior, I ran mostly 5 to 8 km while women run like 12 km with larger elevation difference.

Do you really enjoy running up the hill? And, if it hurts, do you still enjoy it?
Yes, I enjoy exactly that. My dad and I have been attending races since I was a little girl. Then I discovered I had a flair for running and started to devote all my time to it.

When did you start running?
I have a strong family background. My grandfather did sports and so does my father, my sister and I have been guided to sports since childhood and never thought about anything else. Starting as a cross-country skier in a sports club at Česká Třebová, I gradually changed over to running. You know skiers run if there is no snow and I happened to enjoy running more and more until finally I forgot all about skiing. The critical point came when I was about twelve.

Do you do some complementary sports, too?
Not really. You know running takes you quite a lot of time so you appreciate just relaxing afterwards. You would probably get the same answer from most of the athletes: the deepest relaxation is lying in bed and thinking of nothing.

What were the most important races in which you participated?
About four years ago, I started to participate in the World and Europe Championships taking place mostly in Europe because the Europeans engage the most in uphill running. American countries do take part from time to time, but in Africa, uphill running is not much popular so that only teams (mostly men's) from Uganda attend the world championships. The championships most often take place in Italy; with its Alps, it is a great place. Being there you feel like running much more, I do love the mountains. The Italians are great fans, rooting for everybody, making no differences, this really cheers you on. When you feel like you can't go on, hearing those cheers really starts you up.

What has been your biggest success?
I won the Europe championship in Arco, Italy, this was in 2016 holidays, and then I came in second at the world championship in Bulgaria. Well, I personally value more the prize from the world championship as I felt much better in that race. At the world championship, our team also won the gold medal in team running.

Where do you train in Brno or at home? Does it make a difference in which scenery you run?
The CESA surroundings are good for me – when I start running there, it reminds me the scenery of home country. I also do rounds near the Brno reservoir, the countryside there is beautiful and, when I'm downtown, I run to Pisárky or Lužánky, but that's just a matter of habit. Špilberk or Kraví hora are just too small hills and you can run over them in short time. I've grown accustomed to Brno, but going home, I still look forward to visiting my favourite places. I don't run only in the woods, I also train on roads because, in a wood, I can't practise everything that I need.

I guess the most important part of your equipment is shoes. How many pairs of shoes have you got?
We've got loads of shoes at home, mind you, everybody runs having at least twenty pairs ... It doesn't matter much what you put on, but shoes are important. I have a sponsor supporting me materially so this is how I get my shoes. I'm not too demanding though, I only wear down three or four pairs a season.

What care do you take of your body?
I have a massage occasionally, but I know this should be more often. After workout, I take a cold shower of my legs, it's good to cool down the muscles. I admit, though, that I do underestimate regeneration, I ought to be more careful taking sauna and massage regularly.

How did you deserve the BUT Best Athlete of the Year award?
I had to fill in a form entering the achievements of the past season and submit it for evaluation. As I have said, I won the uphill running Europe championship where we were also the first in team running, I won the national championship being the first in the Běchovice–Praha 10 km race and the uphill-running national championship, but this was all still in the junior category. Now I'm up against longer tracks and more competition. There are more women specializing in uphill running in the Czech Republic so this is going to be more difficult and I must increase the load.

Who is couching you?
My dad. We start by setting up a plan at home and, when I'm in Brno, we keep checking the progress by phone. At home, we run together. We run all of us as it is – sister and now mom, too, who seems to have covered more kilometres than we, even if just for leisure, so we'd better be on our guard.

What do you get from sport?
Just positive things – staying in the open air, cultivating body and soul ...

Is there anything you're losing in return?
Not if you don't exaggerate. If you work out to an extreme, your body won't take the load. Now I'm taking more care of my diet to get the most energy from food. A lot of my time is devoted to sports so, if my friends go out to a pub and I have to go to bed because of a race the next day, I do envy them. But the positives prevail. It is simply my life and I couldn't live without running. ■

AWARD


Photo by Igor Šerf

Czech Head Award to a holographic microscope from BUT

A team from the BUT Faculty of Mechanical Engineering and CEITEC BUT received an award in the Czech Head competition. On Tuesday 22nd November 2016, the Czech Head Award of Kapsch, for the best invention, went to a team of scientists who had built a unique microscope for observing live cells without using contrast substances.

As Radim Chmelík, head of the team, said in a statement, the award is an encouragement to continue research especially in the application area of observing live cells using non-invasive methods. The outcomes of the current experiments conducted by the team along with researchers from St. Anne´s Hospital in Brno bring fresh hope that the microscope can be used for cancer treatment on an individual basis. Other members of the team include Pavel Kolman, Zbyněk Dostál and Martin Antoš from the Institute of Physical Engineering at the BUT Faculty of Mechanical Engineering and CEITEC BUT, as well as Tomáš Slabý from Tescan Brno, who also participated in the development of the microscope.

The unique microscope has already been patented in the Czech Republic, EU, USA, China, Japan as well as countries of the Euro-Asian Patent Office.

(ed)

Dragon 7 won the Formula St udent Czech Republic international competition

More than 30 000 hours have been spent by TU Brno Racing producing a new model of the Dragon 7 student formula. This year, the BUT student team has decided to make big changes: replacing the tubular steel frame by carbon monocoque. The latter is used in the F1 racers and in the Le Mans races making the racing cars lighter so they go faster. The new Dragon 7 model was presented by students at the Faculty of Mechanical Engineering in April 2017 and thanks to the successful racing season, TU Brno Racing is TOP 5 student racing team worldwide.

Radka Šťávová, BUT FME and (ed)
Photos by Ondřej Tichý

"Having fine-tuned the tubular steel frame over the last six year, we knew that there was no more leeway to make the car lighter. So, as a team, we decided to use carbon monocoque instead," explained Roman Baxant, the former leader of the TU Brno Racing team. Having been successful several times in the European Formula Student races, the team believed that, thanks to this innovation, "dragon" will continue to appear on the top of the chart in the future, too.

For all the forty BUT students on the team, this involved a complete overhaul of the car's skeleton. While the older frame made it possible to repair each of its parts separately, with the carbon monocoque, everything forms a single unit and the frame must be prepared beforehand. "With no previous experience, we had to deal with a lot of things. But, we are still convinced that, for the future, monocoque is a step in the right direction. Its torsion stability being higher, the car is more stable," said the team leader Baxant. In addition to the change of the frame and the related mounting, students also repaired other things such as the engine unit, unloading the gearbox and rotating the water cooler to improve air access and increase its efficiency.

> Monocoque is a step in the right direction. Its torsion stability being higher, the car is more stable.

At the time of presentation, the pilots tested the car in virtual reality using state-of-the-art technology. With a weight of about 180 kilograms and an engine with a cylinder volume of 510 cm^3, the young designers expected this "dragon" to reach acceleration from rest to 100 km/h in less than 3.4 seconds. In addition to speed tests, the tests verify the reliability and resistance of each part of the car. "In Formula Student, security and car testing receives top priority, which is why we have several boxes in the workshop now with tens of samples we have tested. Even with all the calculations made beforehand, still everything has to be verified by experiments as customary in the development of passenger cars, too," described Baxant.

Forty students have worked on the car since autumn 2016 designing also the outward appearance of the car respecting the distinct lines of the carbon monocoque. The most demanding season for the team is spring when the formula is being put together, with long hours often spent in the workshop. The total amount of work put in by the student team is 30 240 hours. "The expertise I gained while building the formula is great. Working in the student formula, the students learn new ways of thinking about the design and building of cars, with abstract theory suddenly becoming a real experience," added Baxant.

The students' approach and work was praised at an official presentation of the Dragon 7 formula by BUT rector Petr Štěpánek, who also thanked the teachers and sponsors contributing to the creation of the student formula Dragon 7. Apart from the faculty and university management, the unveiling of the new model was attended by car racer David Vršecký and members of the racing team Buggyra. The gala evening then continued by a charity auction for Children's Home Dagmar in Brno. The students collected 40,000 CZK, which is by 15,000 CZK more than a year ago. The most precious piece for the bidders was a piston from last year's Dragon 6 model with a winning bid of 15,000 CZK.

> On the testing track in Most, Dragon became the absolute winner of Formula Student Czech Republic beating all the other 45 racing cars.

This year's first race was the Formula Student East race in Hungary in July where Dragon 7 came in eighth among the world's best teams including electric cars. The Dragon 7 single-seater, on the other hand, chased after the world's top teams in the combustion engine category. However then, Dragon 7 was the first Czech formula to win the Formula Student races on the European continent. In Most, it became the absolute winner of Formula Student Czech Republic beating all the other 45 racing cars. This is a historic record, the team winning the combustion engine category, but achieving a total of 938 points and being more successful than all electric cars, it became the absolute winner of the competition. Currently, TU Brno Racing holds the fifth place in the world's student combustion-engine-formula competition in which more than 540 teams participate. ■

You can launch a major comp any from Brno, too, claims the founder of ROI Hunter

A small local company a few years ago, today ROI Hunter is a major competitor on an international scale with customers all over the world and five subsidiaries through its partnership with Facebook. A graduate from the BUT Faculty of Information Technology, Karel Tlusťák, the founder of the company, says that such an accomplishment is the result of the right choice of people and the courage to keep moving forward.

Kateřina Hrozná
Photos from Karel Tlusťák's archive

The ROI Hunter employees are playful.

Business Factory is how he and his friend called their first agency while still studying at BUT. At that time, Facebook was gaining in popularity in the Czech lands with people using it for advertising to boost their own businesses. Recognizing this hidden potential, Tlusťák designed his own software that could increase his customers' return on investment (ROI). Later on, this technology was taken over by a new, ROI Hunter, company. Achieving good results on the biggest social network, they were noticed by Facebook.

"One day, we got a call from Facebook asking us to come to London to present our technology, which they wanted to use for their accelerator. Although I didn't feel like going at all, I did in the end without much of a preparation. I didn't believe a small Czech firm could mean a thing to them," recounts Tlusťák. ROI Hunter had been chosen among the best eleven companies to closely cooperate with Facebook for the next six months. "Well, we won in the end. It was mainly because what we

> One day, we got a call from Facebook company asking us to come to London to present our technology, which they wanted to use for their accelerator.

were developing made sense to Facebook. In late 2014, we became Facebook's official partner." ROI Hunter ended up ranking among the fifty or so Facebook-supported companies being the only one from Central and Eastern Europe.

They have customers all over the world

To keep among the best, they need to continually improve their technology and achieve good results. Seeing that their campaigns are successfully bringing profit, their customers invest in advertising on the social network, which in turn brings profit to Facebook. For ROI Hunter, this partnership is important because they are among the first to get and test new technologies. Another major benefit is that Facebook delivers the company big customers from all over the world. So many that they had to establish subsidiaries abroad to be closer to the customers. Currently, there are five such as in Brazil and United Arab Emirates. Collaboration similar to that with Facebook is now shaping up with Google.

Employees change the entire company

Apart from proving that worldwide success can also be achieved from Brno, ROI Hunter is an example of different corporate culture partially adopted from Facebook company. "It is our policy to meet the needs of each employee. The skills and abilities are the major drivers of a particular employee's remuneration and career advancement. Another feature of our policy is that the achievement of a milestone will bring a major increase in salaries for the entire department. In this way, people can grow with the company," explains the former BUT student. This approach may be the reason why the company has no problems with fluctuation of employees. The team of employees keeps growing being even joined by two people employed directly by Facebook before. "What is important is that our employees should consider their work a calling rather than an employment enjoying what they do and trying to achieve more. This way, they change the heading and vision of the entire company," he adds.

And what should a man do to match Tlusťák's success? "To select a good team in the first place. And not to care too much about the local market as the Czech one is really small. It is not worth focusing on if you wish to achieve something on an international scale. It is good to use the Czech marketplace as a testing ground to see whether a project is interesting for the customers. If it catches on here, it is likely to do so in other countries, too." ■

At the Faculty of Architecture, European architects learn how to renovate abandoned buildings

Jana Novotná
Visualizations archive of Helena Zemánková

Conversion of Abandoned Buildings and Areas is not just the title of a new publication by Professor Helena Zemánková from the Department of Monument Care of the BUT Faculty of Architecture, but also a motto and purpose of the last quarter of the century of her life. Already in the 1980's, based on her French experience, Professor Zemánková started to collect the themes for studio projects of students at the Department of Monument Care. After the fall of the Communist domination in 1989, the ownership structure of some buildings no longer serving their original purpose has changed. Fortunately, funding and determination were not missing to save the country's industrial heritage. At her studio, she also teaches Erasmus students coming from many European countries.

Professor Zemánková introduced her book on 19th April 2017 when opening an exhibition presenting, as does her book, some projects already successful in saving abandoned buildings and areas. Helena Zemánková herself is the author of several successful conversions. BUT Centre, made together with Václav Zemánek, is the one. In this spirit, she also teaches her students, whose projects will also be on display. Written in English, the book is divided into four chapters. "The first chapter shows examples of successful conversions all over Europe documenting unique approaches to new functional uses. These involve Czech and Slovak projects, too," says architect Zemánková talking about her book. In it, one can also find examples designed by world-renowned architects.

A large number of the buildings presented morphed into centres with creative focus, galleries, libraries, architectural studios, congress centres, museums, hotels, but also residential areas. The examples also illustrate that as different countries may have different architectures, they may have different approaches to conversion.

The second chapter is concerned with cities and their waterfronts receiving new functions. Copious examples refer to famed architects such as the Hafen City in Hamburg and a Port House in Antwerp, Belgium, which is the last project of Zaha Hadid Architects. Another remarkable instance is a World War II submarine base in Lorient, France. Built by the Germans, its structures of enormous strength have resisted any attempt to tear them down. Another classic example is the conversion of a former textile factory and warehouses in Venice, today used by the local faculty of architecture. "The examples suggest different reuse options. Important, though, is the will to have the abandoned buildings playing new parts in the urban development plans rather than to let them fall into disrepair or tear them down as it is the case in Brno where the cultural heritage from the times in which Brno was dubbed Moravian Manchester are still destroyed today," adds the Brno expert.

Conversion design for the Hückel villas in Nový Jičín (Natália Černeyová)

The whole of chapter three is devoted to the conversion of a former silk production factory in Tomioka, Japan, to which Professor Zemánková had been invited years ago, having her students join the project later on. The last chapter is about special cooperation among the European faculties of architecture, particularly in Florence, Seville, Nancy, Saarbrücken and Brno with a workshop about a specific subject, held each year in one of the countries. „Called Re–FACT (reconversion factory), the project represents successful strategies. Last year the workshop took place in Livorno to deal with a conversion of the port with an abandoned silo. One of my students then elaborated on the theme, placing an accommodation facility for refugees," explains the architect naming other topics of the workshops. "A factory hall in Luxembourg is being transformed into a power-engineering museum while, in Brno, we started cooperation with the municipality

Conversion of cargo trans-shipment in Livorno with accommodation for immigrants (Filip Kinnert)

to build a Centre of Creativity from a former prison in Cejl Street."

The venue of Re-FACT is Seville and the outcomes of the workshop held in late March and early April 2017 were not missing in a exhibition. "In addition to European heritage posters, the visitors can see the conversion of the Tomioka factory, which had helped to put it on the world heritage list. It is an excellent example of how the Japanese appreciate their cultural heritage. The site of the former factory is flooded by visitors shown round by devoted local pensioners," says Zemánková. A considerable part of the exhibition consisted of successful student designs. "As an optional course, our students take monument reconstruction in the third year and then another one as part of a master's programme, but they can also attend studios to pick a project theme and actually work on conversion and revitalisation tasks," she explained. Some time ago, for example, 4th-year students submitted plans for salvaging of Hückel villas in Nový Jičín. Here was the home of the owners of the Tonak manufacture, which had been bought by the municipality, and now there are posibilities to explore their reuse. Another topic is the revitalisation of the Technical Museum in Brno suffering from lack of space for its exhibits while in possession of unused land

Tomioka factory is an excellent example of how the Japanese appreciate their cultural heritage.

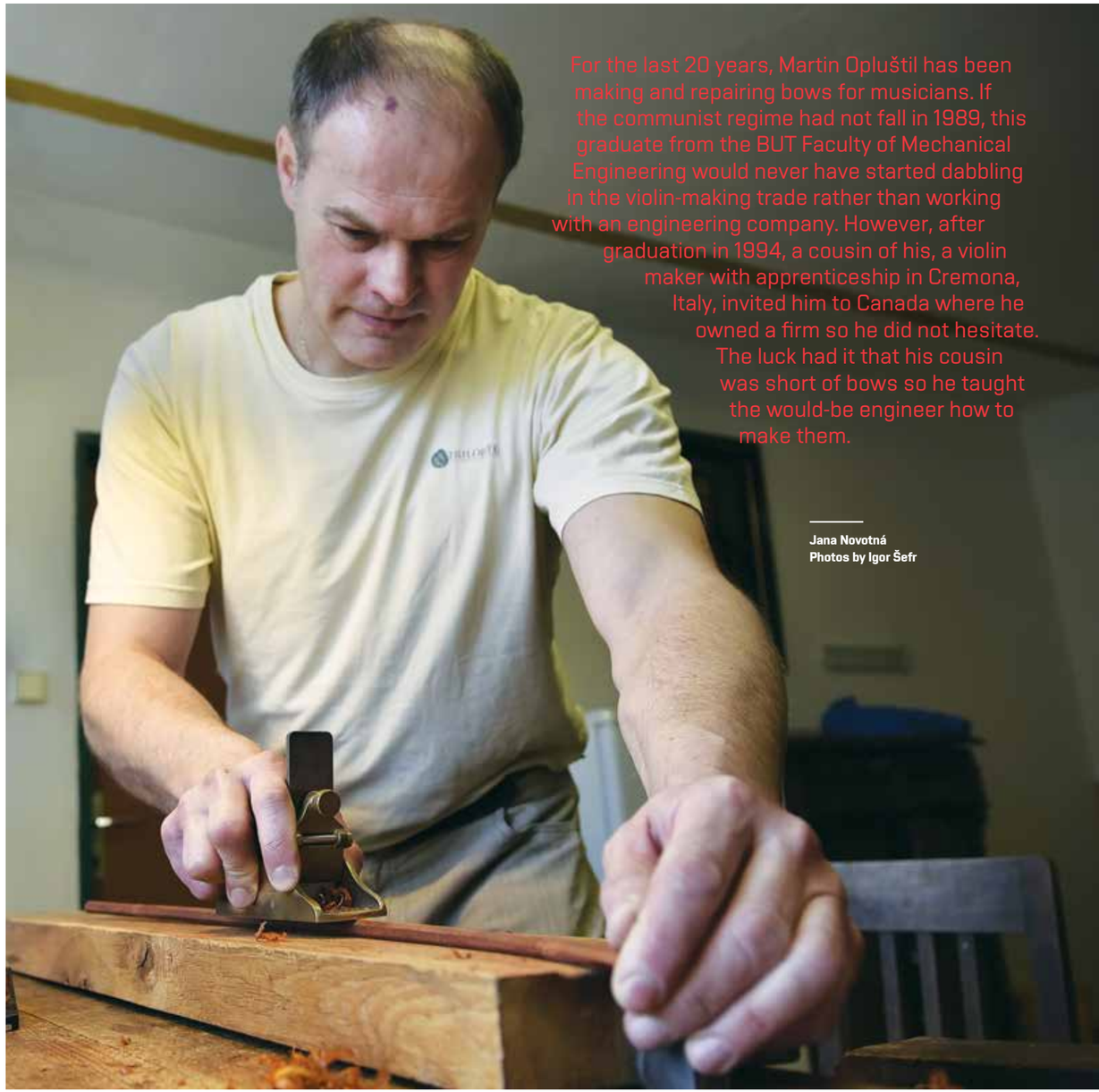
and hall. "We want to draw inspiration from the technical museum in Manchester where canals, bridges and railway overpasses are used to interconnect city zones with mini-railway-carriages. I think that something similar could be done in Brno, too; only using trams instead," suggests Zemánková.

International students can opt for two courses – one about conversion and new functional use and another about the management of cultural heritage. "We have now over 30 Erasmus students from all over Europe, who can present what they know about the approaches to cultural heritage in their homeland. To these students, we offer themes and optional courses to choose from depending on what they intend to specialise in," explains the architect adding: "It's amazing how students from all over Europe meet in optional classes starting dialogues."

Maybe you are still a bit confused about how exactly particular themes find their way to Professor Zemánková and her students. Here is another practical example. "Years ago, I was visited by the owner of a foundry in the former Kolben Daněk factory in Prague. He said that, in the Klementinum library, he had found my book, Create in Created and asked me to give him a hand with a functional conversion. This was a specific task – heavy industry in polyfunctional environment – the students worked out several plans and the owner was enthused," explains the architect, who has dedicated her life to conversion of abandoned buildings. ■

GRADUATE

Bow maker from Haná



For the last 20 years, Martin Opluštil has been making and repairing bows for musicians. If the communist regime had not fall in 1989, this graduate from the BUT Faculty of Mechanical Engineering would never have started dabbling in the violin-making trade rather than working with an engineering company. However, after graduation in 1994, a cousin of his, a violin maker with apprenticeship in Cremona, Italy, invited him to Canada where he owned a firm so he did not hesitate. The luck had it that his cousin was short of bows so he taught the would-be engineer how to make them.

Jana Novotná
Photos by Igor Šefr

"I learnt how to plane with a precision of 0.1 mm, how to bore, file and chisel," reminisces Martin Opluštil. After studies, he decided to try something else while seeing the world. Apart from a cousin in Canada, he had one in New York, too, so he shuttled between them alternating between working and seeing new places. He spent about three and a half months over the ocean, two months learning how to make and repair bows. Learning the basics of the business he left for home. Instead of the military, he managed to arrange a civil service so that he could stay at home making bows. Then, his cousin suggested that he should come again for retraining. "I didn't hesitate and, in June 1996, I started my second trip over the ocean to refine my skills." For four months, he worked as a bow maker earning 300 CAD a week. "These were great times. In four months, I made 25 new bows repairing tens of old ones. After travelling all over the US and Canada for another four months, I said to myself that I knew enough about my craft." In October, I returned home starting my own business the following year on a farm in Březce near Olomouc.

Although asked by many friends why he had not stayed in America, the prospect no longer tempted him. "Why, there's work in this country you can do for a living all right. And I'm just fine here in Moravia, I'd hardly get used to the way of life over the ocean. Then in 1994, I was joking that you would probably meet more pretty girls in Česká Street than you would in the whole of Canada. Maybe it was because, there, all pretty girls were driving a car," says the now well-established bow maker, joking. "When I was in Canada, customers crowded my cousin's workshop, today he says that it's a misery. And I say to him that I have my hands full with orders. There are times I don't manage to make bows for stock or to order as I am working on many repairs. But this may also be because bow making is just a sideline for me," explains Martin Opluštil, who can only be found in the workshop in the afternoons. As bow making requires strong hands, in the mornings, he engages his head instead in a software firm working as a programmer.

In four months I made 25 new bows. After travelling all over the US and Canada for another four months, I said to myself that I knew enough about my business.

He produces bows manually without machines using just tools such as plane, chisel, file, drill, scrapper or emery paper. Modern bows are made from pernambuco wood. "I take a board about 12 mm thick, using a band saw, I cut a stick out of it planing it down to an octagon. Leaving it 1 mm thicker along its entire length, I bend it over heat. I drill a hole at one end for the bolt and a groove for the frog. I stick a plastic plate on the tip, ivory imitation, working it to the final shape. I mount an ivory frog with a nickel or silver rim depending on the quality of the stick. I plane the stick down half a millimetre along the whole of its length equipping it with horsehair and testing it," describes the bow maker. To test a bow, he plays with it on a violin kept particularly for this purpose at the workshop. Then he knows the camber of the bow making it tauter or slacker if necessary. Once the camber is right, the horsehair is stripped and the remaining material removed.

The finished stick is then varnished with shellac, silver wire wound on, skin put on and horsehair returned. For baroque bows, snakewood is used as material with the frog made of ebony or snakewood, too, the screw tip shaped from boxwood or snakewood."

For baroque bows, snakewood is used as material with the frog made of ebony or snakewood, too.

Describing the workflow, Martin Opluštil seems to caress the instrument. "I can't rush the work, that's clear. But when I started, for about the first year, I had to concentrate on what exactly to do and how in each step. Now the workflow seems to have got under my skin, I work like programmed," continues the bow maker. "The stick of the bow wears very slowly, it may outlive a violinist's career, depending on how they play. Most of the violinists have several bows switching between them. To a professional musician, the horsehair will last about a year, sometimes a shorter period," he explains. Customers return to him for repairs and to buy new bows, but there are new customers, too, who have found him on the web. If customers live far away, Martin Opluštil is willing to send them a few bows so that they could make a choice.

"It is my policy to meet all of my customers' wishes such as make a bow with a particular weight, with a specific camber, use a wider leather strip, make a heavier screw, use more horsehair or black horse hair. Some modifications can be done even after a bow is finished," says the bow maker, who has sold his bows to Mexico, Israel, Norway, Poland and Germany. The most expensive bow cost about 1,000 USD. Never mind if a customer doesn't like any of the bows on offer, he may be offered some more later when they are made. Ideas and suggestions from the customers are a natural source of inspiration helping him in his further work. Although customers often invite him to their concerts, he is usually too busy to come. He admits going to the theatre in Olomouc though, where some of his customers play.

Asked if he has ever needed anything he learned at the Faculty of Mechanical Engineering, Martin Opluštil admits basics of programming and work with PC. Still, he likes to think back to his study at BUT. "Those were the great years of study, lots of friends, at the halls of residence I shared a room with Petr Dorazil, the best friend, come to think of it, we must have managed the studies only because we were helping each other."

After 20 years, he still enjoys his work. "Mostly if I make a really good bow or manage to repair a badly damaged one producing a perfect instrument. It is extremely difficult to hold the frog or stick working it with a chisel, plane, file or knife so he sometimes gets palm cramps. Still he says that this is a lifelong profession. "What I'm saying now is that I'm going to stay with this job until I retire, and then, who knows ... Perhaps I will only make repairs and a new bow from time to time, just for fun," says the bow maker from Haná. ■

VISITOR

Photo by Igor Šerf

The South-Korean ambassador has received his own 3D portrait from BUT

On 7th and 8th March 2017, BUT was visited by Mr Moon Seoung-hyun, the new South-Korean ambassador. He was shown round the faculties of information technology and mechanical engineering, and the CEITEC BUT.

The third biggest steel producing company, POSCO, is currently the Czech Republic's most stable South-Korean partner. The NETME research centre and the HeatLAB from the Faculty of Mechanical Engineering headed by Jaroslav Horský have been cooperating with this company since 2004. BUT researchers have been providing it with solutions to problems related to the design and optimisation of cooling systems. This is an experimental research of the cooling of cylinders, plates and profiles, control of heat removal in continual steel casting and questions related to hydraulic descaling.

Mr Moon Seoung-hyun also visited the Faculty of Fine Arts to see a Korean student studying there. During his visit to a 3D studio at the faculty's new site in Údolní Street, the head of the studio Tomáš Medek scanned his head, after which Mr Moon Seoung-hyun was given a copy of his head from a 3D printer.

(ed)

Excel@FIT shows smart solutions and Wi-Fi connectivity safety testing

Radana Kolčavová
Photos by Igor Šefr

Smart parking is an integral part of smart cities. This is exactly the focus of the paper presented at an Excel@FIT conference by Václav Stránský, a student of the BUT Faculty of Information Technology. The new parking system would spare the future drivers the time and trouble of circling round a car park looking for a parking spot while polluting the environment. This smart parking project was among the more than sixty innovative solutions presented by computer science students at the third annual conference held on 3rd May 2017.

"The concept of smart cities is hardly complete without efficient parking solutions. In addition to helping drivers find a free parking spot, the automatic detection of free parking space will limit excessive driving in the car park cutting down the fuel emissions. My project describes a system monitoring the free and occupied parking space to help the drivers navigate on the parking lot with a success rate of over 93 percent," said the author of the project Václav Stránský, a student of information technology in a master's programme. His system uses what is called deep neural networks offering a much better precision compared with the ordinary methods of computer vision. Moreover, there is no need to install sensors into the concrete underneath each parking spot; a surveillance camera will do the job. Another thing is that the system can work in real time on both the graphic card and the processor.

"The system I have designed can also be used to measure the parking time by searching for the occupancy history of a particular parking spot. To test the program, I used the records from a real car park. The reason for this was that the project was based on the requirement of a specific company. To meet the needs of customers, soon another function will be added: the expected time of a particular parking spot being free and other

The concept of smart cities is hardly complete without efficient parking solutions.

advanced statistics concerning the use of a parking lot," added the student, whose work was appreciated by a panel of experts and a wider public, too, receiving also a prize from the industrial partner. Thus, it has succeeded in all three categories.

An information technology project was equally successful. Presented by student Martin Vondráček, a practical tool can be tested by those interested to see how (un)easy it is to attack and broke into their home Wi-Fi network. "Almost everybody could be the victim of a Man-in-the-Middle (MitM) cyber-attack. My tool can be used to increase the safety of networks by automatically detecting their weak points while it is also useful for a forensic analysis. Last but not

least, I would like my project to increase the awareness of information safety," explained Vondráček, the recipient of all three awards.

The task of an expert panel from the Faculty of Information Technology and from industrial companies was to select twenty projects that had major potentials or something that makes them significantly better than the others. The faculty rewarded each author with 7 000 CZK in scholarship. The conference guests and a wider public also expressed their preferences by vote using round blue stickers. A vote carried out directly on the presented posters then provided five projects favoured by a wider public: apart from the above-mentioned smart parking and Wi-Fi testing, another project related to smart cities was met with acclaim. Petr Dobeš created a system to monitor traffic using a 3D model of the passing car based on just a few available snapshots. Another two achievements acclaimed by the public were a project on multi-dimensional automata presented by Zdeněk Hladík and a project of Tomáš Štrba concerning an application for training future drummers.

The golden partners of the third annual Excel@FIT conference were TESCAN and Innovatrics. These and another thirteen silver industrial partners gave their verdicts of twelve student projects, put-

In addition to helping drivers find a free parking spot, the automatic detection of free parking space will limit excessive driving in the car park cutting down the fuel emissions.

ting emphasis mostly on their practical applicability. The total number of student projects presented at Moravia's major informatics conference was 63. All the projects have big potentials in the area of innovations, security, robotics, programming languages, modelling and audio and image processing.

The quality of the projects has been increasing over the years. It is clear that students are interested in offering innovative solutions in various fields of information and communication technology," added Vítězslav Beran, a vice-dean and one of the main organizers of the conference. After the morning presentation of the twelve selected projects by their authors who were also given an opportunity to "sell" their idea to the audience in an attractive and clear way, the present experts and representatives of companies could read the posters and see the prototypes of the new devices as well as technology demonstrations of the faculty partners from the application sphere. This year's conference has been visited by over three hundred guests. ■

ExFoS 2017

The importance of forensic engineering today, eligibility of forensic engineers, issues concerning false expert opinions, these were among the topics of ExFoS 2017, an international scientific conference held in late January. Among the papers receiving much attention was one presenting an analysis of the tragic collision between a bus and a pedestrian occurring in 2015 in Zlín. It was this expert's opinion that saved the bus driver from prosecution then, serving as a legal precedent today.

Jana Novotná
Photos by Igor Šefr

The first meeting of forensic experts, assessors and experts in technical and economic fields at an international level took place in Brno 26 years ago at the BUT Institute of Forensic Engineering." The biggest contribution of ExFoS is that it creates an ideal space for sharing the latest findings in forensic engineering while being a meeting point of the practical forensic experts and academic experts," said Pavel Maxera, a doctoral student at the institute and a participant in the conference.

According to Vladimír Adamec, a member of the organizing committee, the conference was attended by more than two hundred experts from public administration, universities and both domestic and foreign research and forensic institutes listening to 56 interesting presentations. "Already in the common section on the first conference day, there was a lively discussion about the present forensic activities. That the conference programme has been found really interesting by the participants can be seen from their lively response," added Vladimír Adamec, naming some interesting topics. Radek Visinger, director of the judicial surveillance department, talked about activities by the Ministry of Justice concerning forensic engineering and their limits. In the same section, a pressing question was raised of the forensic-expert-fee, so often complained about. This problem was explained by Miroslav Frýdek from the department of justice, migration, and finance of the Ombudsman's office. Miroslav Fryšták, a penal law expert from the Pedagogic Faculty of Masaryk University in Brno, received much attention with his practical reflections and observations. "In his presentation, he talked mainly about the role of an expert opinion in the hierarchy of proofs in criminal proceedings, pointing out some formal requisites of an expertise whose absence may diminish its credibility and persuasiveness," explained Vladimír Adamec.

After the plenary section, the discussion concentrated on practical experiences and matters concerning the research projects as applied to forensic activities and forensic expert education. In the section of road accident analysis, motor vehicle, machine and equipment assessment, Stanislav Tokař from the BUT Institute of Forensic Engineering presented the results of Crash Day 2016. These may help monitor vehicles in road accidents, increase vehicle security, and improve the software instruments simulating road accidents used by experts. "No doubt, the presentations of our colleagues from the Department of road accidents, specifically those focusing on the crash tests, were the most stimulating part of this conference," added Pavel Maxera, referring to an analysis by Martin Bilík of the already mentioned road accident in Zlín.

The most interesting presentations of foreign participants were those by the Polish colleagues from the Institute of Forensic Research in Cracow. Jan Unarski presented the results of a research into the effect of electronic devices on the drive security of motor vehicles. Comparing the numbers and types of devices in vehicles influencing the driver's perception, he assessed the effect of each device and some combinations of devices on drive security. In part of his research, Unarski pointed out the effect of the music genre on the driving style, which plays its part, too. His colleague Piotr Ciepka, in turn, talked about the outcomes of a research into the motorcycle deceleration time." This is the period from the beginning to the full effect of braking. In his research, Ciepka proved the deceleration time to be longer than in cars while comparing the types of braking in experienced and inexperienced drivers, which also show considerable differences," explained Adamec.

The building and estate valuation by participants section that followed included a lecture by Šárka Šilarová from the Faculty of Civil Engineering of the Czech Technical University in Prague concerned with failure issues and diagnostic examples of contact thermal insulation systems. An important section of risk engineering has been part of the conference focusing on risk management and ways of applying such methods in forensic engineering. This section provides a meeting point for experts from technical and economic fields to exchange a spectrum of information applicable to both practical and research problems. Much inspiration, for instance, came from a lecture by Petr A. Skřehota from the Forensic Institute of Safety and Health Protection about failures of the human factor and shortcomings of the system of work management. "Its main contribution consisted in the innovative search for the real causes of work accidents applying the methods of risk engineering in forensic practice," pointed out Adamec mentioning another topical presentation. Vladimír Smejkal from the BUT Faculty of Business and Management talked about the importance of risk analysis as an instrument of the prevention of cyber crime given by the ever increasing addiction to information technologies.

All the lectures could also be attended by doctoral students of the forensic engineering program to draw inspiration for their dissertations and research. Some of them even presented their own findings. ■

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Jaroslav Juřica between art and industrial design

Although Jaroslav Juřica enrolled for industrial design at the BUT Faculty of Fine Arts (FFA), he graduated from the sculpture studio. In the meantime, however, he had received a Master of Industrial Design degree in Sweden. Already during his studies, he rather vacillated between industrial design and art and seems to continue doing this in his professional career, too. In his portfolio, you will find a scooter for the grown-ups, for which he received a Red Dot Award for industrial design in 2016, as well as cubist chessmen in limited edition that carry characters of a sculptor's hand.

Jana Novotná
Photos archive of Jaroslav Juřica

For Jaroslav Juřica, the path to industrial design started at the secondary school of furniture at Bystřice pod Hostýnem where he started as a carpentry apprentice leaving with an certificate as an artistic woodworking craftsman. He enjoyed playing with wood doing marquetry and so, after school, he and his fellow-student started to think of doing design. The straightest way was to Brno and, as he was not admitted to study product design at the BUT Faculty of Fine Art at first, he started to study at a restoration college. "I just wanted to stay on," explains Jaroslav Juřica. "I started to visit a Design Centre (an institution established by the Ministry of Industry and Trade in support of design development), which was my first link with the universe. There I could borrow journals trying to read as much as possible about industrial design."

One day, all of a sudden, Jaroslav quit the restoration college. He already knew that he did not want to restore furniture, what he wanted was to design it. Before that, he had done a civil service in Rousínov where he could use workshops to make his little models while attending drawing courses and preparing for entrance exams at the Faculty of Fine Arts. Then, at the Design Centre, he learnt about a Young Package competition, registered for the young-designers-under-40 category and won with his design of golf-ball box (2001). "This made my admission to BUT a lot easier. In addition, having got a financial reward, I could buy my first computer and start doing 3D visualisations," says the designer talking about his start.

When studying product design led by Zdeněk Zdařil, he got a special prize of the jury in a CityPoint competition for his design of concrete bench (2005) still manufactured today. Paradoxically, though, he earned his Bachelor's degree supervised by Michal Gabriel. The theme of his final project was children's playground, which started to tend towards a statue rather than a design. His sculpture experience helped him get many things straight. "While I kept talking about a user, Michal Gabriel argued that a sculpture has a spectator rather than a user. I used this to clear my head and sort out the concepts."

The need to find a function for everything started to gain ground in the young author. Until today, however, he has to deal with nescient clients from time to time, who only care about the good look of a thing. "Asking about what we're going to do if it doesn't work, sometimes the client's answer is, never mind it's just a design. Well, that really makes me angry!" says the excited designer. With a smile, he tells me how, as students, they saw the approach to design to be the same in the future, as today it is to music. As someone might prefer Bowie or Madonna, so in design, some people will buy Starck and others Karim Rashid. "Well that was about the author design. But then, there is also what is called hardcore industrial design, which is more anonymous but the more sophisticated," explains Jaroslav Juřica.

His views on design have strongly been influenced by his Swedish experience. Advised by Jan Čtvrtník, he applied for admission to School of Industrial Design in Lund and was successful. The two years (2008–2009) of study for Master's degree that followed had brought him an experience entirely different from the one at BUT. "In Sweden, the approach to teaching design was quite different, much more pragmatic and disciplined with a lot of analytic classes and searches," says the successful graduate of a Swedish university with part of the study done at the Demakersvan – Dutch Design House. After returning from Sweden, he headed for the FFA sculpture studio again. "When I was in Sweden, Michal Gabriel from FFA started to build a 3D studio, which caught my interest and, moreover, there was a half finished job we shared. I wanted to get familiar with new technologies so I decided to finish my studies there. Although 3D printing was more expensive at that time, still it was cheaper than in Sweden and the atmosphere was much more experimental and enthusiastic here," explains Jaroslav, who used 3D technology to write his master's degree project called The Inner Universe, which brought him Rector's Prize (2010).

He likes experimenting, which may sometimes meet with lack of understanding. Such as when he was expected to design a paper box and he made it from porcelain.

Soon after finishing university, the young designer marked a major success with his Chair 002 design. Done on the occasion of the 150th anniversary of the TON Company, the design earned its author an Interior Innovation Award (2012) and nominations in German Design Award (2012) and Czech Grand Design (2011). Here, Juřica combined the proven technology of wood bending with a new shaping solution cutting down the number of components to three: the seat plus two identical pieces of bentwood. The result gives the eye an impression of lightness hiding

the tedious work behind. "The process of creation always consists of several phases one of them being a moment of despair and scepticism, but that's also part of it," adds the author joking.

However, to think that the winning chair design was a magic wand bringing the designer new orders would be wrong. Furniture still forms the bulk of his work, but today mostly ordered by the Jelínek Company, which addressed him looking for some fresh blood. The LaVista bedroom has become the company's new flagship winning a price of editors-in-chief in the Designblock 2014 competition and triggering successful cooperation, which is still lasting. "I've grown up with furniture so I suppose I could say that I'm good at designing it. On the other hand, though, I do like the growing diversity of projects saving me from doing the same thing over and over again. There's always something new coming," says the designer with a really varied portfolio.

In addition to school designs you may find in that portfolio an interactive CD cover, a Rubikon cut-out sheet, which becomes a working camera obscura after pasting as well as a Moon survey tool storage system developed as part of the NASA's S.T.A.R. programme, and the Brick + 20 % EXTRA of the absurd products edition,

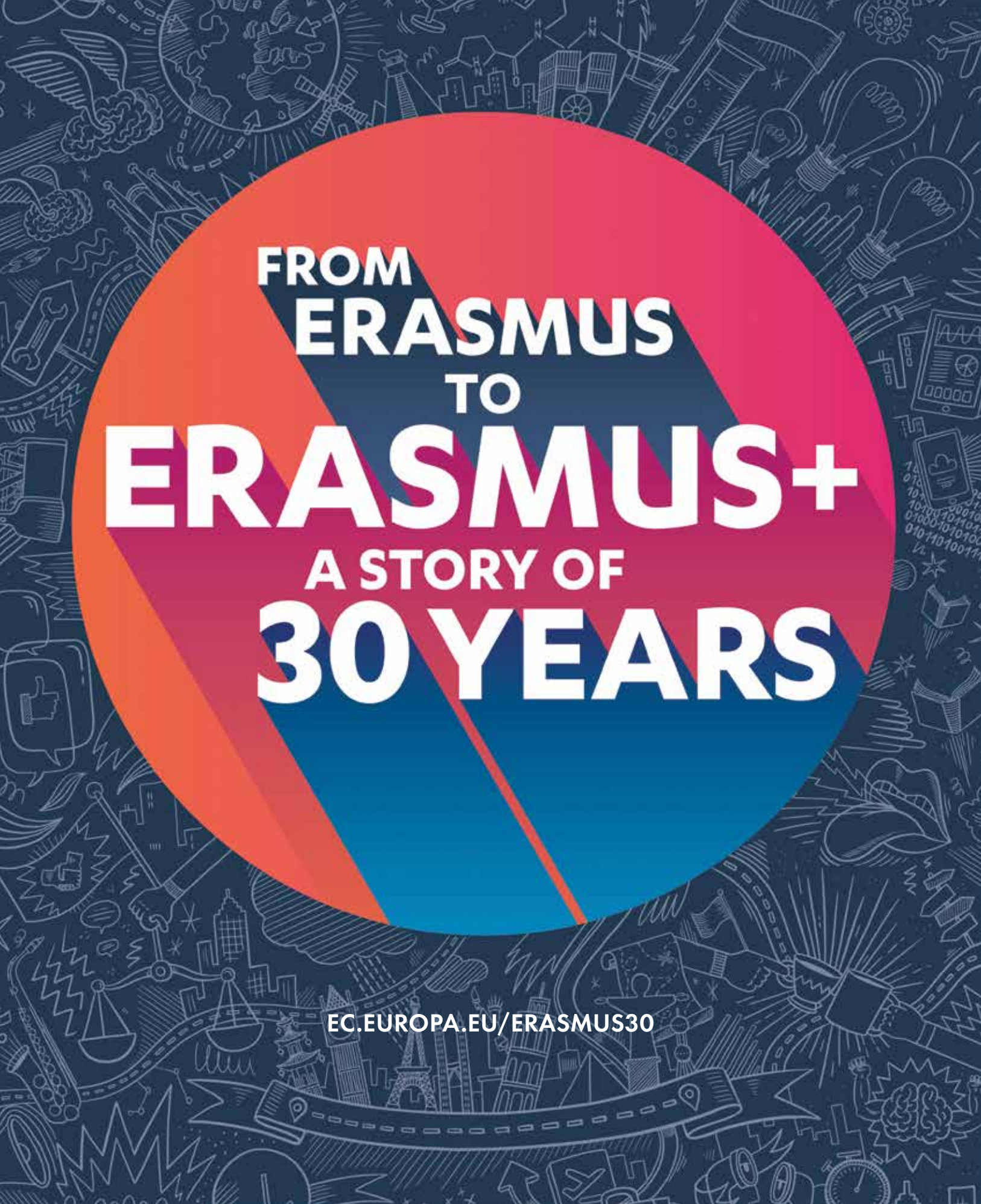
which is a reaction to the business strategy of bonuses. There is also a jewel case in the art category that, surprisingly, combines materials as disparate as almost burned wood and artificial stone or the above-mentioned carved cubic chessmen created as a tribute to the Czech cubism. To luxurious material, Juřica enhanced ordinary plywood using it to design a clothes peg or a rocking dog for children. When not being used, both the above artefacts may serve as interesting soliteurs.

In 2016, Jaroslav Juřica won the Red Dot Award for designing a scooter for grown-ups for Yedoo. "Even if the product has only been one year on the market, the award is sure to have a positive impact on its image," says the successful designer, who himself encouraged the manufacturer to register for the competition, but despite the international success, he keeps both feet on the ground. As industrial design may also be regarded another project of a house accumulator, which is about to be finished as well as a new order of a furniture collection for rental houses. "In this last mentioned case, I certainly experience the scepticism phase I talked about. This being something entirely new to me, I hardly know what the result is going to be, but I enjoy the chance," says the designer laughing.

If you ask Jaroslav Juřica whether he feels more at home in industrial design intended for serial production or in works of art created in limited editions, his answer will be in both. "What I like most about all this is exactly the overlaps. These two areas interact supporting each other and working on one thing gives me the rest I need from the other. Right now, I've been working on a pipe, which is basically a sculptor's job. It belongs to the things that are not necessarily viewed through its function, but rather as something that conveys some expression," explains the designer.

The designer's profession should work with the unexpectable.

Even if wood was at the beginning of Jaroslav Juřica's career, he himself has no material preferences. On the contrary, he likes experimenting, which may sometimes meet with a lack of understanding. Such as when he was expected to design a paper box and he made it from porcelain. "The client was surprised so I suppose there will be no implementation. I designed a cover that, through its fragility, should provoke respect to its content right from the outside," says the author. But I'm convinced that this is not the wrong way. "The designer's profession should work with the unexpectable. Although one is asking for trouble, quick profit should not get the upper hand, courage and wilderness should be present too." ■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