PÍŠTĚK, V.; KUČERA, P.; FOMIN, O; LOVSKA, A. Effective Mistuning Identification Method of Integrated Bladed Discs of Marine Engine Turbochargers. Journal of Marine Science and Engineering, 2020, vol. 8, no. 5, p. 1-12. ISSN: 2077-1312.

Description of the result

At present, exhaust gas turbochargers not only form the basis for the economical operation of petrol, diesel, or gas engines of all power categories, but also have an irreplaceable role on reducing their emissions. To reduce emissions from internal combustion engines, various systems are being developed, all of which have a turbocharger as an important component. Demands on turbocharger system durability and reliability keep growing, which requires the application of increasingly advanced computational and experimental methods at the development beginning of these systems. The design of turbochargers starts with a mathematical description of their rotationally cyclic impellers. However, mistuning, i.e., a slight individual blade property deviation from the intended design parameters, leads to a disturbance of the rotational cyclic symmetry, which causes fatigue fractures of the blades and significant economic losses. This article deals with the effects of manufacturing-related deviations on the structural dynamic behaviour of real turbine rotors. As opposed to methods exploiting expensive scanning vibrometers for blade experimental modal analysis or time-consuming accurate measurement of the geometry of individual blades using 3D optical scanners, the article deals with an effective method of mistuning identification for cases of integrated bladed discs of marine engine turbochargers. This new method is based on using only a simple laser vibrometer in combination with a FEM computational model of the integrated bladed disc. The added value of this method is, in particular, a significant reduction in the cost of laboratory equipment and a reduction in the time required to obtain the result. The use of this method is not limited to the bladed discs of turbochargers but has universal application in the entire field of turbomachinery, which is also documented by the citations of this article.

The article is included in Q1 and has 18 citations in WOS and 31 citations in Scopus (without auto citation). Among the authors who cite this article, the importance of their universities can be highlighted: University of Sheffield, ENGLAND; Salford Royal NHS Foundation Trust, ENGLAND; Regensburg Univ Appl Sci, GERMANY; IRCCS Istituto Neurologico Besta, Italy; Polytechnic University of Milan, ITALY; Universidade da Coruna, SPAIN; Escuela Tecn Super Ingn Ind, SPAIN; Universidad de Las Palmas de Gran Canaria, SPAIN; Universitat Politecnica de Valencia, SPAIN. It can also be noted that the number of views of the article is in the thousands, as there are already 2317 hits on the pages of the journal and this article. More information is in the attached document.

The method was developed in cooperation with foreign colleagues from State University of Infrastructure and Technologies, Kyiv, Ukraine, and Ukrainian State University of Railway Transport, Kharkiv, Ukraine.

The basic ideas and principles of the new method described in the article were conceived at the BUT in Brno, where laboratory measurements were also carried out on turbine wheel blades using laser technology. In cooperation with foreign colleagues, some special modules of the created software for processing and evaluating the measured data were designed and validated.

Number of citations 18 in Web of Science (without auto citation):

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