Discrete Single Element Fractional Capacitor; $\alpha = 0.5$, $C_\alpha = 40$ nFs$^{-0.5}$

Key Features

- **Typ. fractional order: $\alpha = 0.5$**
- **Typ. fractance: $C_\alpha = 40$ nFs$^{-0.5}$**
- **Typ. operational bandwidth: (2.5 – 400) kHz**
- **Max. absolute error in phase: 1.95 deg**
- **Thick-film technology design**

Typical applications

- **Frequency filters**
- **Signal oscillators**
- **Synthetic immittance elements**
- **Fractional-order circuits and systems**
- **Behavioural modelling**

General description

The capFOE_05 is an experimental prototype of passive capacitive type fractional-order element; fractor; featuring typical values of fractional order $\alpha = 0.5$ and fractance $C_\alpha = 40$ nFs$^{-0.5}$.
The element is based on resistive-capacitive layered structures with distributed parameters (RC-EDP). The production of the element was performed in a thick-film technology. The dimension of capFOE_05 is 48 mm × 5 mm (excluding pins).

Specifications

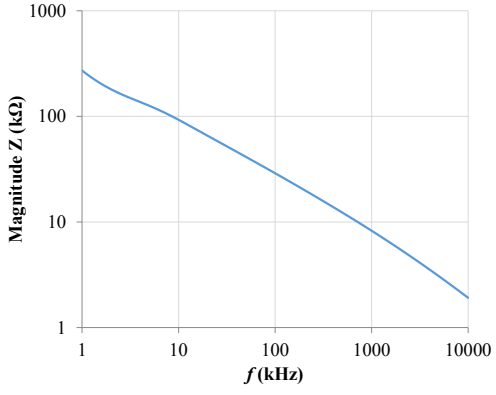
Table 1. Electrical characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Fractional order	α	**0.49**	**0.5**	**0.53**	**-**
Fractance	C_α	**26**	**40**	**51**	**nFs$^{-0.5}$**
Min. frequency of operation	f_{min}		**2.5**		**kHz**
Max. frequency of operation	f_{max}		**400**		**kHz**
Impedance magnitude[1]			**51**		**kΩ**
Impedance phase[1]			**-45.6**		**deg**
Max. absolute error in impedance magnitude[1]				**8.3**	**kΩ**
Max. absolute error in impedance phase[1]				**1.95**	**deg**
Max. relative error in impedance magnitude[1]				**15.9**	**%**
Max. relative error in impedance phase[1]				**4.2**	**%**

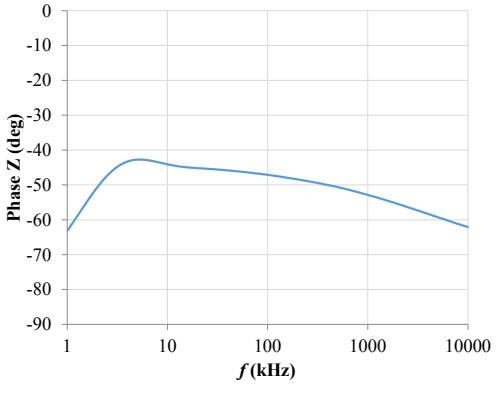
[1]at central frequency 31.6 kHz

Electrical characteristics

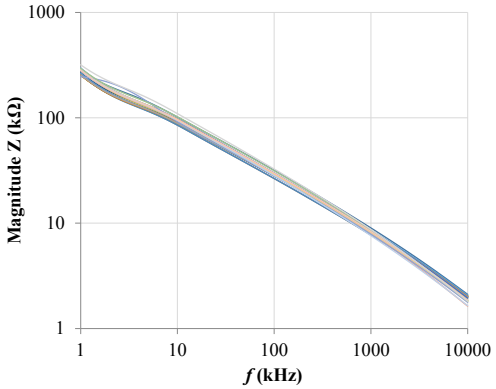
Impedance magnitude of the capFOE_05 (typical)



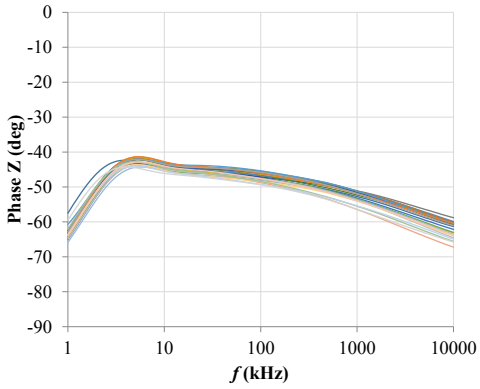
Impedance phase of the capFOE_05 (typical)



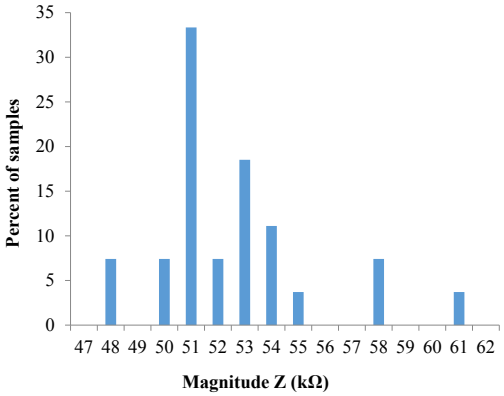
Impedance magnitude of the capFOE_05 (26 samples)



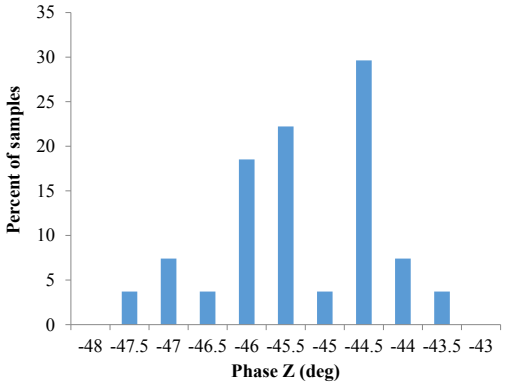
Impedance phase of the capFOE_05 (26 samples)



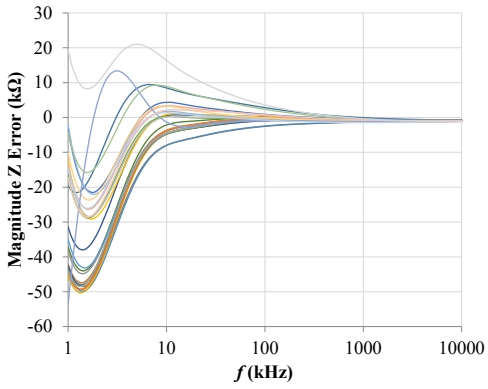
Histogram of impedance magnitude of the capFOE_05 at central frequency 31.6 kHz (26 samples)



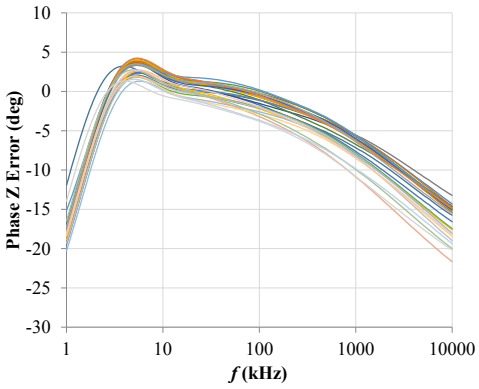
Histogram of impedance phase of the capFOE_05 at central frequency 31.6 kHz (26 samples)



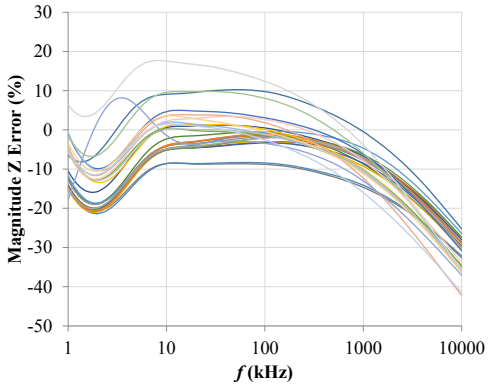
Absolute error in magnitude of the capFOE_05 (26 samples)



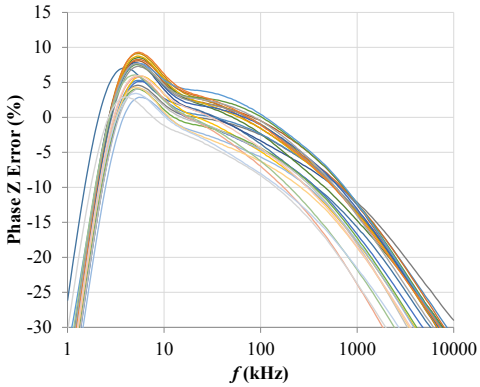
Absolute error in phase of the capFOE_05 (26 samples)



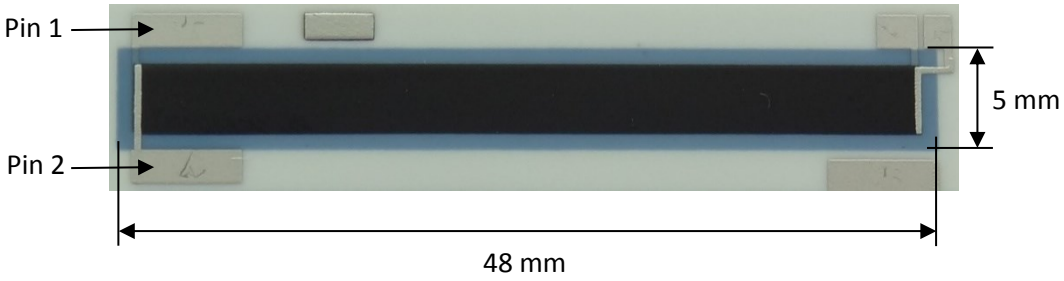
Relative error in magnitude of the capFOE_05 (26 samples)



Relative error in phase of the capFOE_05 (26 samples)



Top view of capFOE_05 and dimensions



The design of the capFOE_05 prototype was done within the INTER-EXCELENCE COST project No. LTC18022, Czech Republic, and as a contribution to COST Action CA15225.

MINISTRY OF EDUCATION, YOUTH AND SPORTS

INTER-EXCELLENCE COST

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Fractional
COST Action CA15225; fractional-systems.eu