

**FRACTIONAL-ORDER CONTROL SYSTEMS:
MODELLING AND SIMULATION**

Ivo Petras ¹, Lubomir Dorcak ²

Abstract

This paper deals with fractional-order controlled systems and fractional - order controllers in the continuous, discrete and frequency domain. The mathematical descriptions by the fractional differential equations, fractional difference equations and fractional transfer function are presented. Practical numerical algorithm for new type of controllers is described as well.

The paper also presents some alternative types of discretization methods (discrete approximation) for the fractional-order differentiator and their application to the dynamical system described by the fractional differential equation (FDE).

The ways for discrete modelling of fractional-order systems are illustrated with the numerical examples and obtained results are discussed in conclusion.

Mathematics Subject Classification: 26A33, 93C55, 93C80

Key Words and Phrases: fractional calculus, fractional-order digital controller, fractional - order control system, constant phase margin system, power series expansion, continued fraction expansion, simulation