

A Rulkov neuronal model with Caputo fractional variable-order differences of convolution type

Oana Brandibur, Eva Kaslik, Dorota Mozyrska, Malgorzata Wyrwas

Abstract: In this paper, a theoretical and numerical investigation is undertaken for a fractional-order version of the Rulkov neuronal model, involving Caputo fractional variable-order differences of convolution type. As a first step, using linearization techniques and the Z-transform method, sufficient conditions are explored which guarantee the stability or instability of the unique equilibrium point of the system. Numerical simulations are further carried out to illustrate the theoretical findings, emphasizing the differences between the current model and simpler versions involving fractional-order difference with constant fractional orders, as well as the classical integer-order Rulkov model.

¹⁾ Oana Brandibur, M.Sc. (Ph.D. student): West University of Timisoara, Institute e-Austria Timisoara, cam. 045B, Romania (RO), oana.brandibur@e-uvt.ro .

²⁾ Eva Kaslik, Associate Professor: West University of Timisoara, Institute e-Austria Timisoara, cam. 045B, Romania (RO), eva.kaslik@e-uvt.ro .

³⁾ Dorota Mozyrska, Associate Professor: Bialystok University of Technology, Wiejska 45A, Poland (PL), d.mozyrska@pb.edu.pl .

⁴⁾ Malgorzata Wyrwas, Ph.D.: Bialystok University of Technology, Wiejska 45A, Poland (PL), m.wyrwas@pb.edu.pl , the author presented this contribution at the conference in the special session: "Advances in fractional order modelling and control" organized by C. Muresan, C. Pinto and E. Dulf.