Comparing approaches between numerical simulations and emulations by electronic circuits in a fractional dynamic model– CNM 2017

Sergio A. David*, Clóvis Fischer† and Clivaldo de Oliveira††

* Department of Biosystems Engineering (ZEB)
University of São Paulo - USP
Av. Duque de Caxias Norte, 225 Pirassununga, Brazil
e-mail: sergiodavid@usp.br, web page: http://www.fzea.usp.br/?page_id=3413

† Department of Biosystems Engineering (ZEB)
University of São Paulo - USP
Av. Duque de Caxias Norte, 225 Pirassununga, Brazil
e-mail: cfischer@usp.br, web page: http://www.fzea.usp.br/?page_id=3358

†† Faculty of Engineering (FAEN)
Federal University of Grande Dourados - UFGD
Rodovia Dourados - Itahum, km 12, Dourados, Brazil
e-mail: clivaldooliveira@ufgd.edu.br, web page: http://www.ufgd.edu.br

ABSTRACT

In this paper, we revisited a work recently reported in the literature involving chaos suppression in a nonlinear fractional order macroeconomic dynamic model. In order to confirm the feasibility of the theoretical model proposed and the numerical simulations results presented in aforementioned work, Cadence OrCAD package is used to simulate electronic circuits for emulation of the system behaviour. Integer order and several fractional orders of this system are analyzed. Electronic circuits that simulate mathematical nonlinear equations are implemented by means of analogic integrators, summers, multipliers and the fractance circuits units with capacitors/resistors lattices. The $\frac{1}{s^{\alpha}}$ term that represents a fractional integration in Laplace domain is approximated with a s-domain transfer function with zeros and poles adjusted in frequency domain. Thus, the resistors and capacitors values are determined and the respective electronics schematics circuits are developed and simulated. Comparisons obtained between numerical simulations results and the emulated electronically by the circuits proposed results show a very similar and consistent behaviour in both approaches.

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