Universidad Rey Juan Carlos

Modelización de sistemas biológicos: Sincronización en redes de neuronas

Roberto Lozano

Directores: Miguel A. F. Sanjuán, Javier Used

Jornada Científica en Homenaje al Prof. Miguel Ángel Fernández Sanjuán

12 de Diciembre

FOURIER ANALYSIS OF A DELAYED RULKOV NEURON NETWORK

Commun Nonlinear Sci Numer Simulat 75 (2019) 62–75

Contents lists available at ScienceDirect

Commun Nonlinear Sci Numer Simulat

journal homepage: www.elsevier.com/locate/cnsns

Research paper

Fourier analysis of a delayed Rulkov neuron network

Roberto Lozano[a,*], Javier Used[a], Miguel A.F. Sanjuán[a,b]

[a] Nonlinear Dynamics, Chaos and Complex Systems Group, Departamento de Física, Universidad Rey Juan Carlos, Tulipán s/n, Móstoles 28933, Madrid, Spain
[b] Department of Applied Informatics, Kaunas University of Technology, Studentu 50-415, Kaunas LT-51368, Lithuania

ARTICLE INFO

Article history:
Received 21 December 2018
Revised 8 February 2019
Accepted 17 March 2019
Available online 21 March 2019

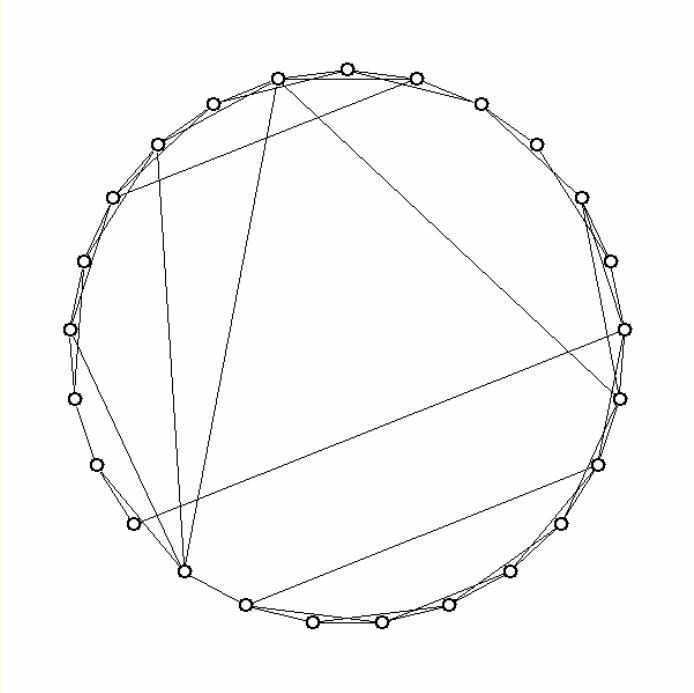
Keywords:
Rulkov model
Synchronization
Neuron networks
Signal analysis

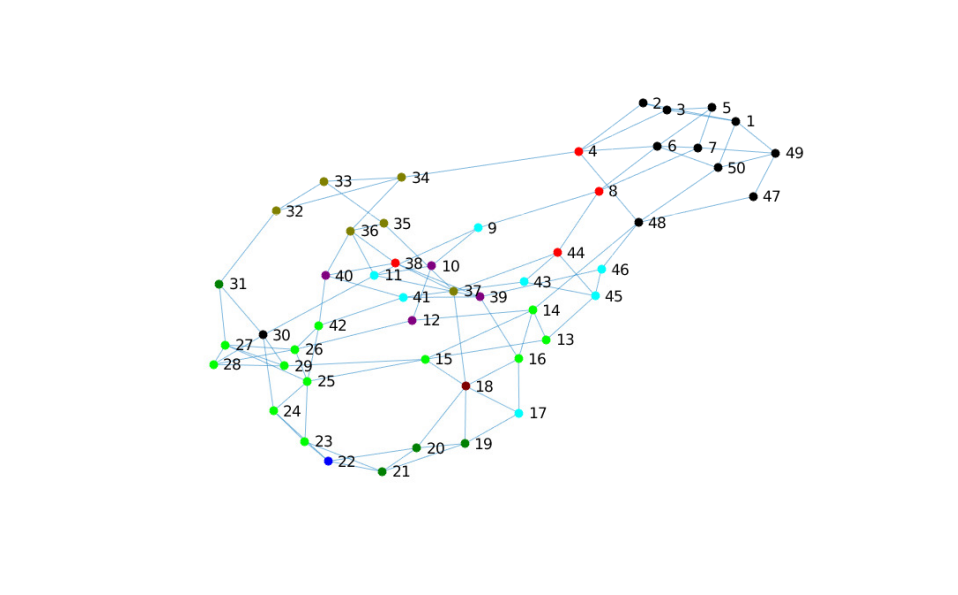
ABSTRACT

We have analyzed the synchronization of some different networks of chaotic Rulkov neurons with an electrical coupling that contains a delay. We have developed an algorithm to compute a certain delay whose result is to improve the synchronization of the network when it was slightly synchronized, or to get synchronized when it was desynchronized. Our general approach has been to use tools from signal analysis, such as Fourier and wavelet transforms. With these tools, we have characterized the behavior of the neurons for different parameters in frequency and time-frequency domains. The algorithm has been applied for two well-known network models: the small-world and Erdös-Rényi. We have also tested the algorithm by using non-homogeneous neurons affected with a parametric noise.

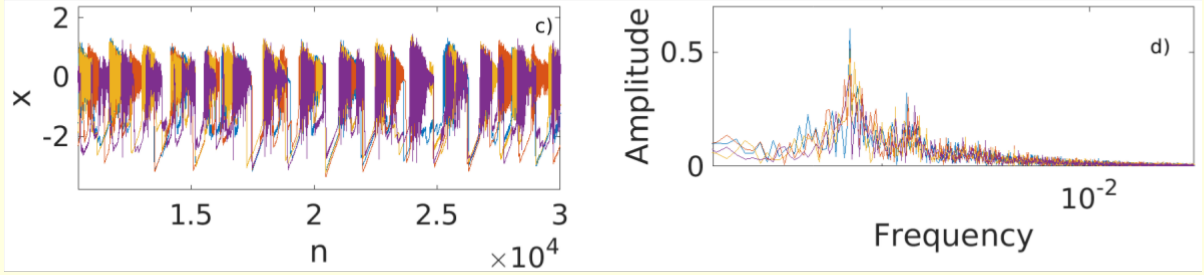
FOURIER ANALYSIS OF A DELAYED RULKOV NEURON NETWORK

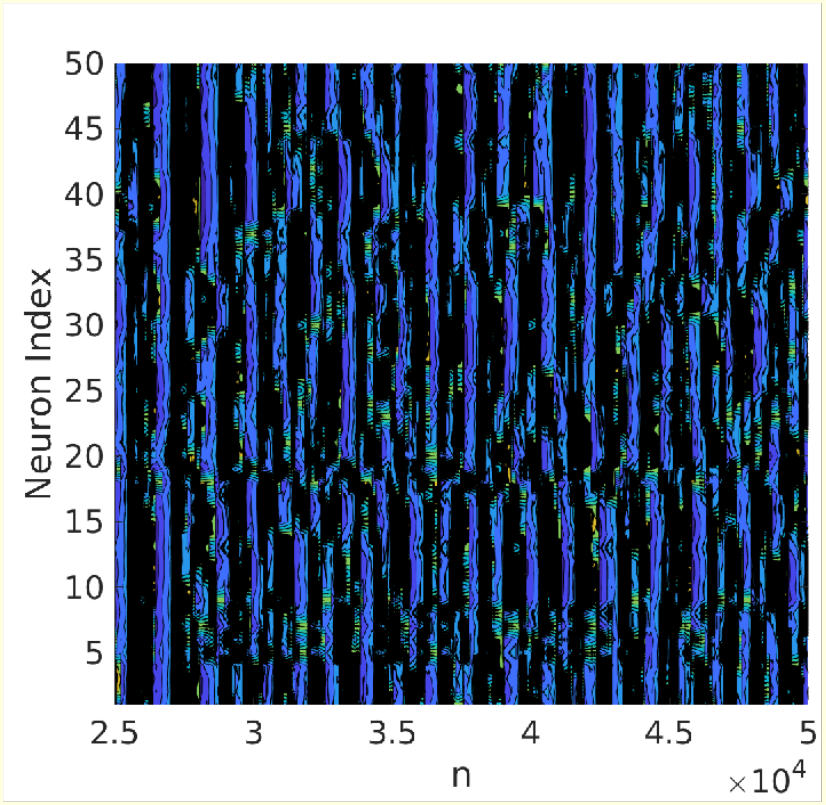
$$x_n = \frac{\alpha}{1+x^2} + y_{n-1} + \delta\left(Ax_{n-\tau} - Dx_{n-1}\right)$$
$$y_n = y_{n-1} - \beta\left(x_{n-1} - \sigma\right)$$

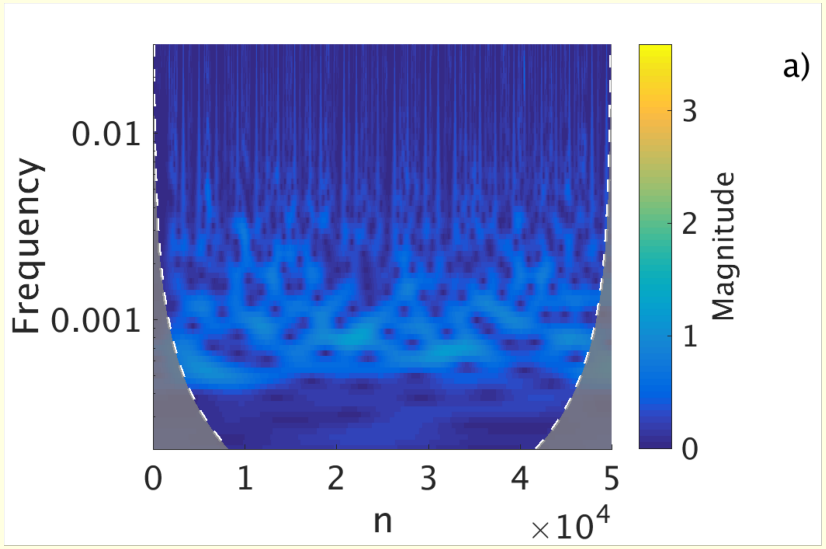




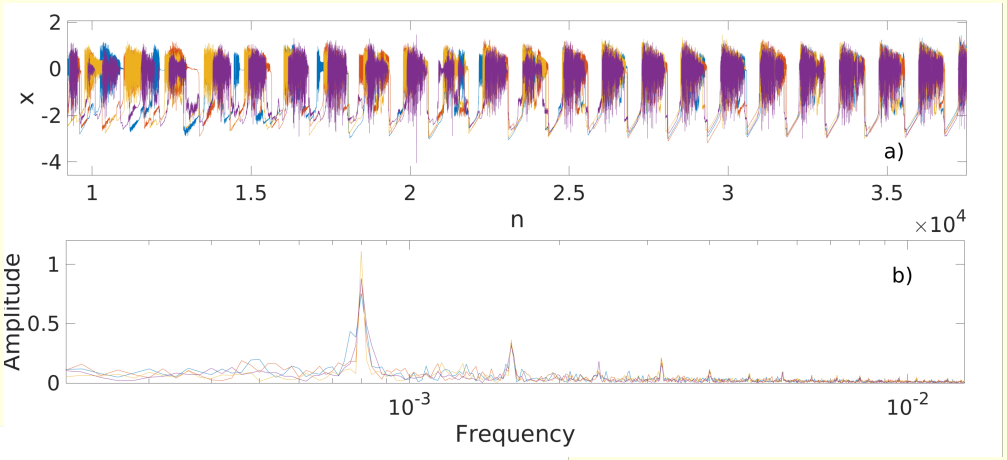
FOURIER ANALYSIS OF A DELAYED RULKOV NEURON NETWORK

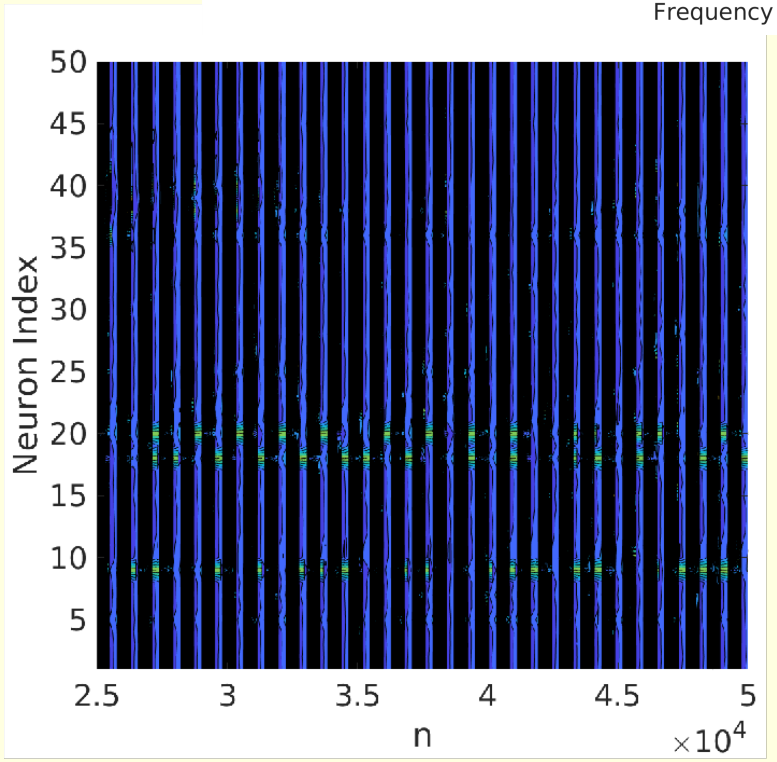


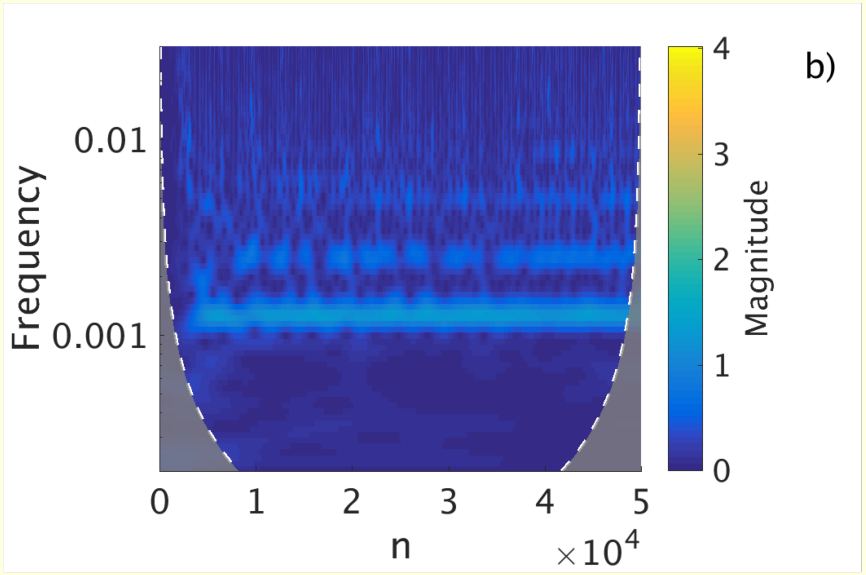




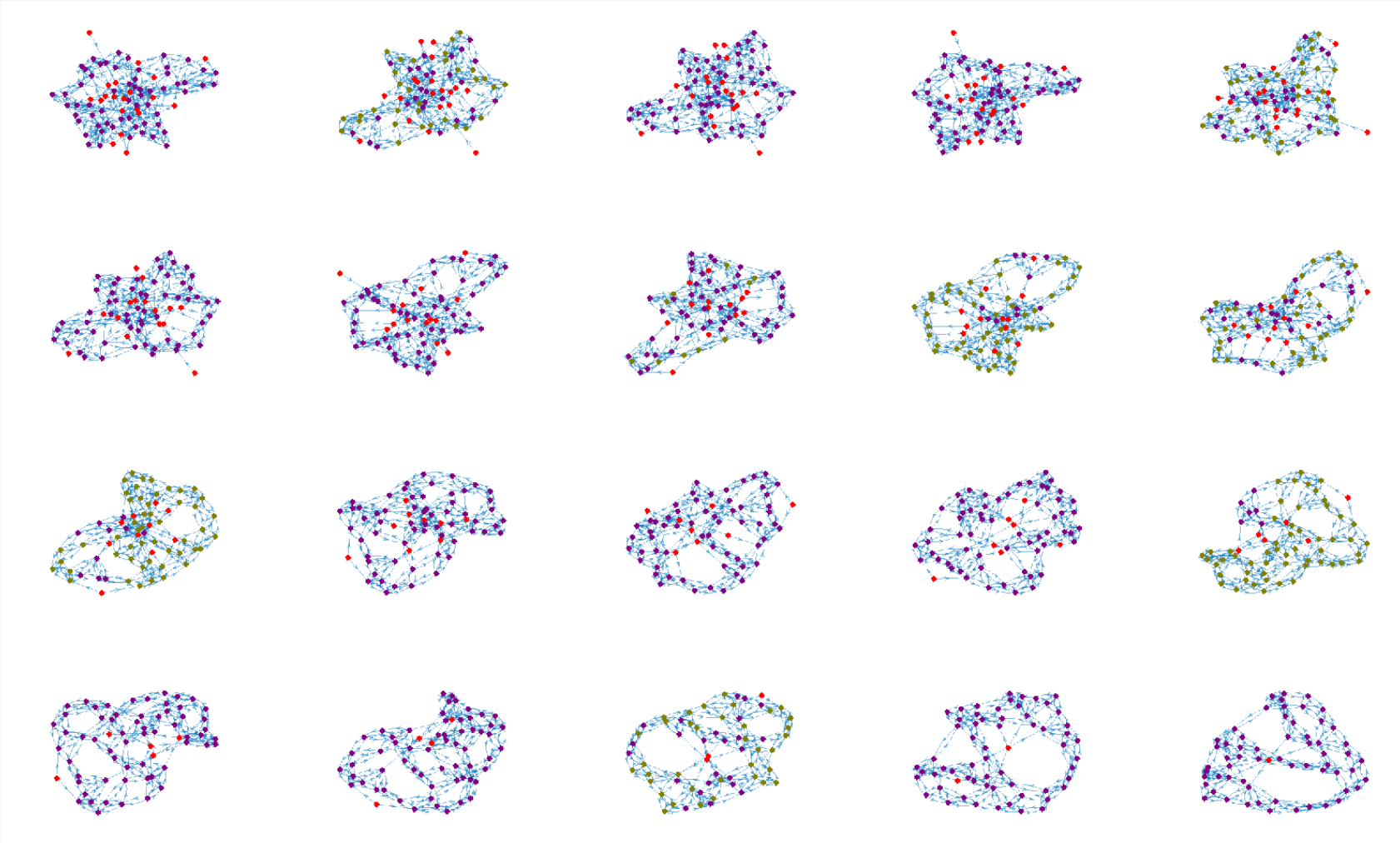
FOURIER ANALYSIS OF A DELAYED RULKOV NEURON NETWORK



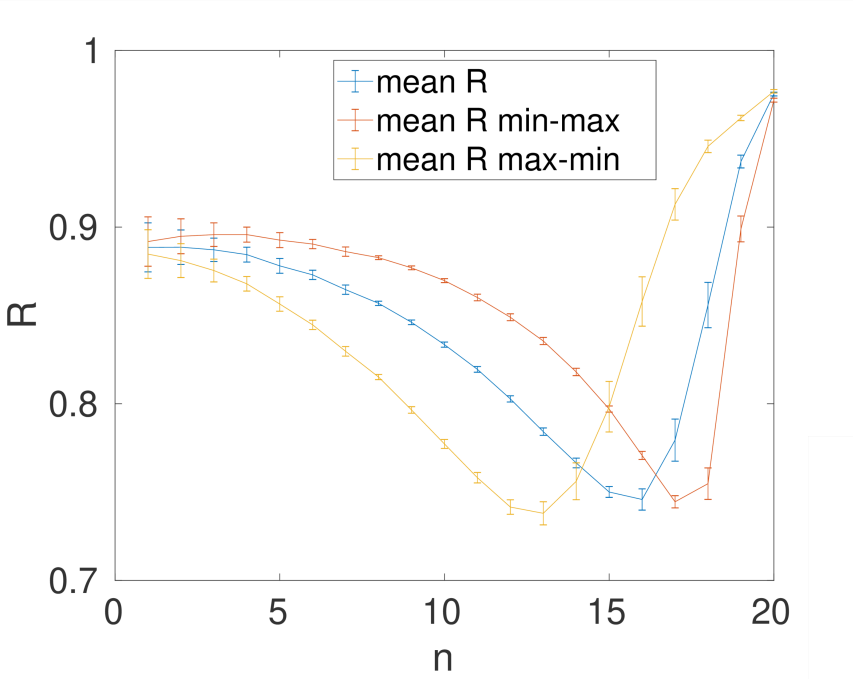


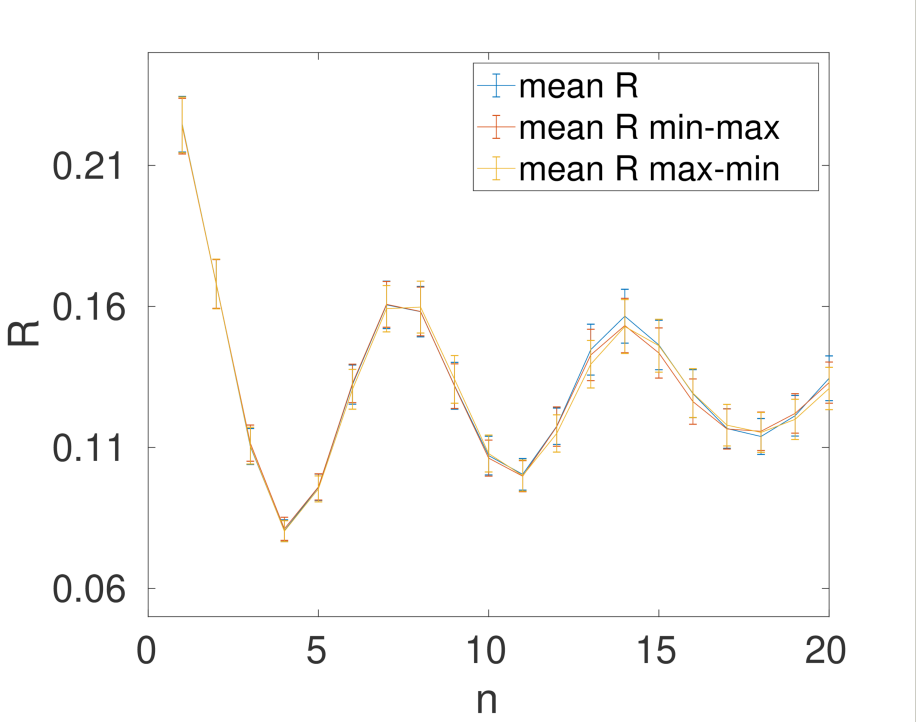


ÚLTIMOS RESULTADOS

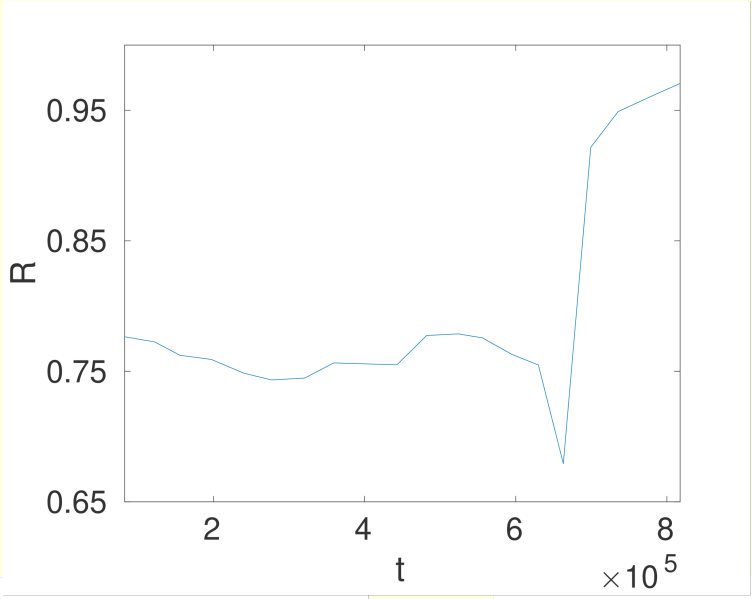


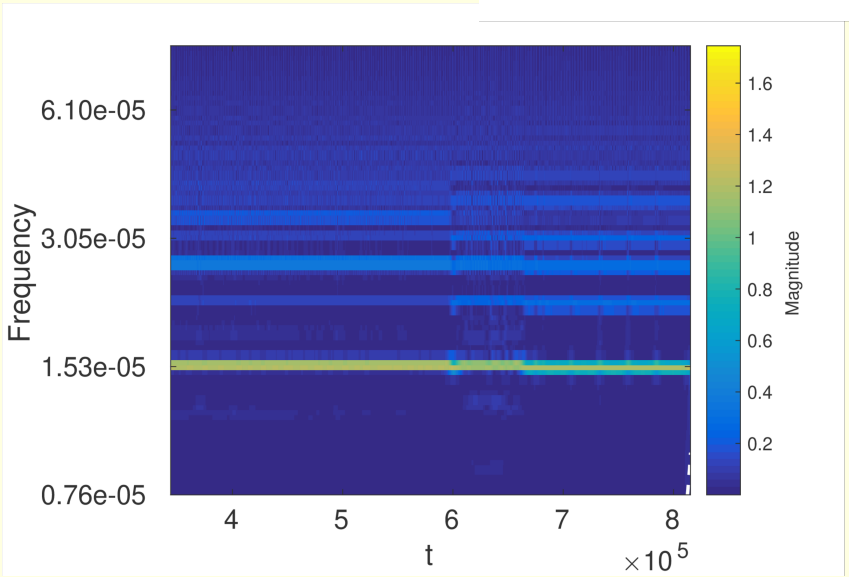
ÚLTIMOS RESULTADOS

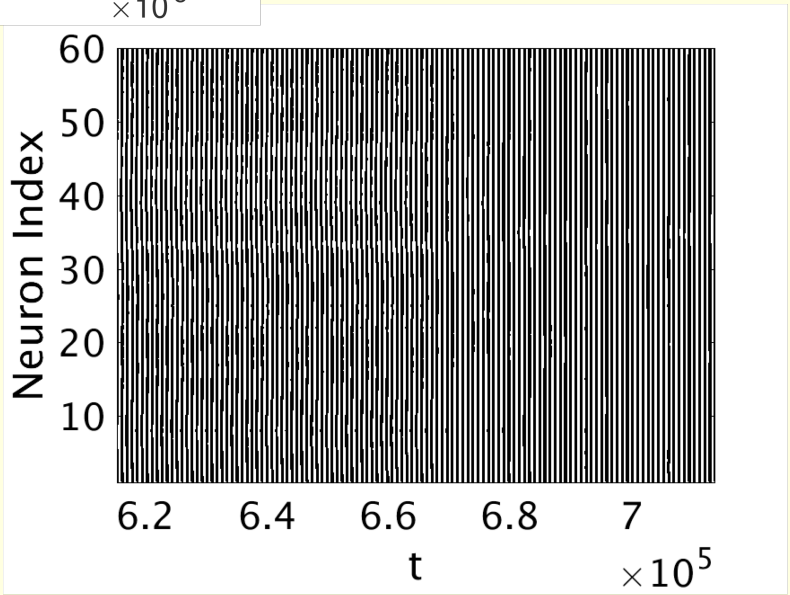




ÚLTIMOS RESULTADOS







Universidad Rey Juan Carlos

¡Gracias!

Jornada Científica en Homenaje al Prof. Miguel Ángel Fernández Sanjuán

12 de Diciembre