

Structural stability of interaction networks against negative external fields

José Fernando Mendes

Abstract: In this talk I will show how we can explore the structural stability of weighted and unweighted networks of positively interacting agents against a negative external field. We show that the agents support the activity of each other to confront the negative field, which suppresses the activity of agents and can lead to a collapse of the whole network. The competition between the interactions and the field shapes the structure of stable states of the system. In unweighted networks (uniform interactions) the stable states have the structure of k-cores of the interaction network. The interplay between the topology and the distribution of weights (heterogeneous interactions) impacts strongly the structural stability against a negative field, especially in the case of fat-tailed distributions of weights. We show that apart from a critical slowing down there is also a critical change in the system structure that precedes the network collapse. This change can serve as an early warning of the critical transition. In order to characterize changes of network structure we develop a method based on statistical analysis of the k-core organization and so-called 'corona' clusters belonging to the k-cores.

¹⁾ José Fernando Mendes, Professor: University of Aveiro, Campus Santiago, 3810-193 Aveiro, Portugal (PT), jfmendes@ua.pt, the author presented this contribution at the conference in the special session "A special session dedicated to Prof. Miguel A.F. Sanjuán on the occasion of the celebration of his 60th anniversary" organized by J. Awrejcewicz.