University of Ferrara

Dottorato in Neuroscienze Traslazionali e Neurotecnologie

Seminario

Containing malicious cascades on complex systems: from power systems to epidemics spreading

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Lunedì 9 maggio 2022, ore 11:00

Sezione di Fisiologia Umana, aula F10

Chiostro S. M. delle Grazie, primo piano, via Fossato di Mortara 19, FE

n. 1 credito

Prof. Luciano Fadiga

Coordinatore del Dottorato in Neuroscienze Traslazionali e Neurotecnologie

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Abstract

Systems where many components/agents interact can display complex phenomena, that cannot, in most cases, be explained only by the behavior of each of its components. Examples of this type of systems, among many others, are the power grid and the COVID-19 pandemic. In this seminar, the concepts that allow these systems to be described as complex systems are introduced. After this, solutions for diverse modelling and control tasks proper of these systems are shown, always under a complex systems approach.

In the power grid, the main last resort strategy for cascading failures containment is that of partitioning the grid in energetically independent clusters, commonly known as islands. We introduce a novel self-organizing failure containment strategy based on the migration of nodes among predefined islands of the power grid. The strategy relies on a distributed power balance estimator based on virtual consensus dynamics.

The COVID-19 pandemics has highlighted that social distancing is a key factor to fight epidemic spreading. However, it also hampers our economic system, leaving policy makers to face the delicate task of seeking the optimal trade-off between public health and economic sustainability. Well before the Italian government decided to follow this path, we showed how combining tools from network science, data-driven modelling, and optimal control it is possible to design regional containment strategies ensuring protection of public health at a relatively low economic price.