

# Lectures

18<sup>th</sup> June 2015: 9 – 13

Department of Engineering, University of Ferrara  
Via Saragat 1E – 44123 Ferrara (FE)

*Prof. Krzysztof Patan*

Lecture title (2 hours): **Dynamic neural networks in modeling, control and fault diagnosis**

The lecture is a comprehensive review of neural networks with dynamic properties and possibilities of their application in control engineering. In the framework of control engineering neural networks has gained much attention due to their possibilities to deal with nonlinear problems. The fundamental task which is discussed is to derive an accurate model of the plant considered. The problem of selecting a proper data as well as training process are portrayed. Properly derived model can be then used, e.g. for synthesis of a control system or to design a fault diagnosis subsystem. The lecture presents some neural network based control schemes, namely inverse model control, feed-forward control, internal model control or model predictive control. Neural network models can be also use to design model-based fault diagnosis.

*Dr Bartłomiej Sulikowski*

Lecture title (2 hours): **Application of Linear Matrix Inequalities in control of dynamical systems**

During this talk, a short introduction into the Lyapunov theory towards the control problems will be given. Also, the links between Lyapunov theory and Linear Matrix Inequalities will be presented. Case studies will consider standard state-space systems (differential and discrete) and additionally the subclass of 2D systems (so-called spatially interconnected systems). Main focus will be put to formulate the common tasks from the control theory (stability investigation, controller design etc.) in terms of LMIs. The material presented during lectures will be also evaluated with Matlab computations and simulations.

## Speakers Profiles

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**Prof. Krzysztof Patan** is Associate Professor at the Institute of Control and Computation Engineering, University of Zielona Góra, Poland. His research interests include artificial intelligence methods, especially dynamic neural networks, modelling of dynamic systems, model-based fault diagnosis, fault tolerant system design, global optimization methods and medical diagnosis. His research interests include stability and robustness of neural network model predictive control, fault tolerant control using state-space neural models, fault tolerant control using linear parameter varying models, time-frequency analysis methods in seizure classification.



**Dr. Bartłomiej Sulikowski** is Assistant Professor at the Institute of Control and Computation Engineering, University of Zielona Góra, Poland. His research interests include applications of multidimensional ( $nD$ ) systems and repetitive processes,  $2D$  ( $nD$ ) systems control, and numerical analysis of a class of  $2D$  systems using  $1D$  equivalent model. His teaching activities involve issues on data security, computer networks (CISCO Local Academy instructor), introduction to computer programming, and numerical methods.