RATIONAL APPROXIMATION FOR DATA-DRIVEN MODELING AND COMPLEXITY REDUCTION OF LINEAR AND NONLINEAR DYNAMICAL SYSTEMS (MS - ID 69)

Dynamic neural networks and model order reduction for the simulation of electronic circuits

Wil Schilders

TU Eindhoven

w.h.a.schilders@tue.nl

In recent years, there is a strong drive towards the use of artificial neural networks combined with more traditional simulation techniques based upon physical modelling. Karniadakis and his team at Brown University are frontrunners in this field, using so-called Physics Informed Neural Networks (PINNs). At Philips Research, we worked on dynamic neural networks for the simulation of electronic circuits. We were able to establish a 1-1 connection between the specific networks used, with special neuron activation functions, and state space models. On the one hand, this connection enabled us to predict the topology of the artificial neural network. For example, the number of hidden layers turned out to depend on the multiplicity of eigenvalues of the matrix A in the state space model. On the other hand, this connection could potentially also lead us to a theory of model order reduction for neural networks. In the presentation, we will review the artificial networks, establish the 1-1 connection and discuss the resulting implications.