

Control of oscillator networks using symbolic regression

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Abstract

The control of general complex systems is an important and difficult task. Applications range from mechanics to life sciences, concrete examples are turbulence control, the control of cardiac arrhythmia or tremor control. In this talk, we investigate the possibility to establish an analytical control law from data. As theoretical model, we chose a hierarchical network of nonlinear oscillators as a simplified model for the human brain. In the case of tremor it is known that the synchronized firing of neurons leads to undesired behavior. Consequently, we step from the control two coupled oscillators over a 1D and 2D regular grid to a Dorogovtsev hierarchical network. It turns out that control is always possible, but the details of the result depend critically on the formulation of the cost function. We focus on the method and explain weaknesses and strengths of the approach.

Biography

Prof. Dr. Markus Abel received his undergraduate degrees in mathematics and physics from Saarland University and his masters degree with best marks in RWTH Aachen, Germany. He received his PhD in Potsdam University, where he also performed his Habilitation thesis. He is currently a Professor at Potsdam University, the Chief Operating Officer at AmbroSys GmbH, and the Chief Technical Officer of 4cast GmbH. Markus's cross-disciplinary work seeks to provide physical understanding and develop algorithms for complex systems, including turbulent fluids, energy systems and traffic. He is currently pioneering the use of machine learning algorithm for the prediction of complex dynamical systems in engineering.