

Open Master Thesis Project

Extremum Seeking Control

DESCRIPTION

In many practical applications, there arise optimization problems, where the decision variable is or can be viewed as the output of a dynamical system. The control task is then to design an input to the dynamical system, such that it asymptotically solves the optimization problem and the system output eventually settles at an optimal value, which minimizes a given cost function. As a very simple case, the cost function might be cell signal strength, and the dynamical system might be a human cell phone user on a bike, in search for maximal radio reception.

Generally, the aim is to steer the output of the dynamical system in a descent direction of the cost, which often makes use of gradient information. Extremum Seeking Control describes a class of model-free controllers, which employ a learning based control methodology that shares many similarities to reinforcement learning. The adaptation (learning) is executed in a gradient-free way by applying so-called dither (learning) signals and current information on the cost only, in order to induce system output which approximates a desired gradient descent. Extremum Seeking Control can be formulated in time-continuous or discrete time variants, combined with stochastic or deterministic approaches.

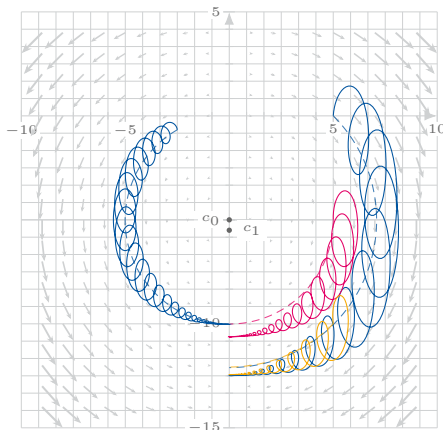
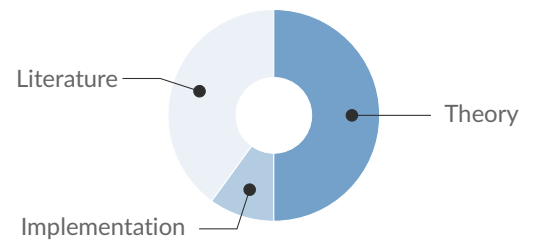


Figure 1: Orbits of Extremum Seeking controlled system and the orbits they approximate.

In this thesis, you will pursue research in the context of Extremum Seeking Control, starting from existing results. Possible directions, which are up for discussion, are MRAC-design using ESC, instability results for ESC with bounded update rates and ESC with stochastic input sequences. You will be encouraged to implement demonstrational examples and numerically solve them, but the thesis will be focused on theoretical results.

PROPERTIES



AREA

Nonlinear Control

Optimization

PREREQUISITES

Nonlinear Control



Optimization



BEGINNING

any time

CONTACT

Marc Weber

@ marc.weber@ic.rwth-aachen.de

📍 Kopernikus Str. 16, 52074 Aachen

🏢 Chair of Intelligent Control Systems

🌐 <https://www.ic.rwth-aachen.de>