ABSTRACT

GALVÃO, M.L. *Extremum Seeking for Stefan Partial Differential Equation with Moving Boundary.* 70 f. Dissertation (Master Degree Course in Electronic Engineering) - Faculdade de Engenharia, Rio de Janeiro State University, Rio de Janeiro, 2022.

This dissertation presents the design and analysis of the extremum seeking for static maps with input governed by a parabolic partial differential equation (PDE) of the diffusion type defined on a time varying spatial domain described by an ordinary differential equation (ODE). This is the first effort to pursue an extension of extremum seeking from the heat PDE to the Stefan PDE. The compensation of the average-based actuation dynamics is performed by a *backstepping* controller via backstepping transformation for the moving boundary, which is utilized to transform the original coupled PDE-ODE into a target system whose exponential stability is proved. The local exponential convergence to a small neighborhood of the optimal point is proven by means of backstepping methodology, Lyapunov-Krasovskii functional and averaging in infinite dimensions. The extension for the delay-compensated extremum seeking control of the Stefan problem is also discussed.

Keywords: Adaptive Control. Extremum Seeking. Partial Differential Equation. Averaging Theory. Infinite dimension systems. Backstepping Transformation.