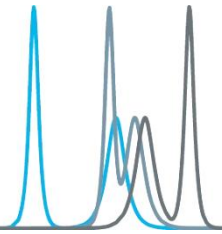

Lehrstuhl für Analysis und Modellierung

Lehrstuhl-Seminar
Sommersemester
2021

Prof. Anthony Roberts

University of Adelaide

Macroscale, slowly varying, models emerge from the microscale dynamics in long thin domains

24. Juni 2021 - 9:00
WebEx Meeting

Abstract: Many practical approximations in science and engineering invoke a relatively long physical domain with a relatively "thin cross-section". Extant mathematical approximation methodologies are typically either self-consistency or limits as the aspect ratio becomes unphysically infinite. Via a simple example system, I discuss how to analyse the dynamics based at each cross-section in a rigorous Taylor polynomial. Then centre manifold theory supports the local modelling of the system's dynamics with coupling to neighbouring locales treated as a non-autonomous forcing. The union over all cross-sections provides powerful new support for both the existence and emergence of a centre manifold model global in the long, finite-sized, domain. This leads to novel quantitative estimates of the error made by slow space approximation. I also discuss how the Complex Ginzburg-Landau PDE for the modulation of pattern evolution is rigorously supported by embedding the physical system in an ensemble of all its phase shifts. The approach discussed may be used to quantify the accuracy of known modelling approximations, to extend such approximations to mixed order modelling, and to open previously intractable modelling issues to new tools and insights.

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