Pacific Institute *for the* Mathematical Sciences

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Multiple Scales and Their Coupling in Mathematical Modeling

Prof Dr Roderick Melnik

Tier I Canada Research Chair in Mathematical Modelling

Director, MS2Discovery Interdisciplinary Research Institute

Abstract:
Coupled nonlinear mathematical models are essential in describing most natural phenomena, processes, and man-made systems. From large scale mathematical models of climate to modelling of quantum mechanical effects coupling and nonlinearity go often hand and hand. Coupled dynamic systems of partial differential equations (PDEs) often provide a foundation for the description of many such systems, processes, and phenomena. In majority of cases, however, their solutions are not amenable to analytical treatments and the development, analysis, and applications of effective numerical approximations for such models become a core element in their studies. In this talk we will discuss three examples of coupled mathematical models. Starting from nanoscale low dimensional systems such as quantum dots (QDs), we'll move to mesoscopic models for phase transformations (PTs), and we'll conclude with coupled multiscale problems in studying biological structures constructed from ribonucleic acid (RNA), providing further insight into their application areas and the development of computationally efficient procedures.

UNIVERSITY OF SASKATCHEWAN
College of Arts and Science

Department of Mathematics and Statistics
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