Department Colloquium
Mathematics and Statistics
York University

Date, Time, and Room

Thursday October 10, 2024
1:30PM-2:30PM
HNE B17

Speaker

Dr. Woldegebriel Assefa Woldegerima
York University

Title

Multi-scale Differential Equations in Mathematical Biology

Abstract

Biological and physical systems evolve across different spatial, temporal, and size scales. Modeling such complex systems gives rise to multi-scale differential equations that may be written as ODEs, PDEs, DDEs, SDEs, or Difference Equations. One common phenomenon encountered in multi-scale differential equations is the occurrence of singular perturbations. Singular perturbation theory (SPT) provides insights into systems where regular perturbation methods fail due to multiple scales. Theories such as the Tikhonov–Fenichel's Theorem and Geometric Singular Perturbation Theory (GSPT) are powerful mathematical tools for analyzing multiple- time-scale systems. This public lecture will introduce the general theory of multi-scale differential equation models with a focus on applications in biomathematics. We will discuss singular perturbation theory, a key mathematical approach to studying these complex equations by exploiting the presence of distinct time or spatial scales. Through examples, we will explore the application of SPT to various biological models, including fast-slow ecological models, quick dynamics epidemic models, multi-time scale vector-borne models, and the method of multi-scale techniques for general nonautonomous systems.

Refreshments in Ross N620 at 2:30PM

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