

# Franklin & Marshall College and Millersville University

## ***A Virtual Joint Colloquium in Mathematics***

Thursday, November 12, 2020, 4:00-5:00pm EDT

Professor Robert Miller, University of Louisiana at Lafayette

### Nonlinear Size-Structured Population Models with Indefinite Growth Rates and an Environment: Finite Difference Analysis and Application

**Abstract:** A numerical method is developed for a general structured population model coupled with the environment dynamics over a bounded domain where the individual growth rate changes sign. Sign changes notably exhibit nonlocal dependence on the population density and environmental factors (e.g., resource availability and other habitat variables). This leads to a highly nonlinear PDE describing the time-evolution of the population density coupled with a nonlinear-nonlocal system of ODEs describing the environmental time-dynamics. Stability of the first-order finite-difference numerical scheme and its convergence to the unique weak solution are proved. Numerical experiments are provided to demonstrate the performance of the first order finite difference scheme and to illustrate a range of biologically relevant potential applications. We also briefly summarize the development of a second-order scheme and provide some examples to motivate the theory.

**Bio:** Robert Miller is an assistant professor in the civil engineering department at the University of Louisiana at Lafayette. Dr. Miller's research focuses on the development, analysis, and application of conservation law models occurring in problems arising in water resources, environmental engineering, and biological population dynamics. Prior to joining UL, Dr. Miller worked for 11 years in the private sector as a water resources engineer on numerous projects including site drainage design, FEMA map development and floodplain management, environmental impact assessments, watershed master plans, and coastal restoration studies. Dr. Miller obtained his PhD in applied mathematics with an emphasis on structured population dynamics in 2015 from the University of Louisiana at Lafayette and is a registered professional engineer in Louisiana.

Please contact one of the individuals below for the Zoom link to this event.

Contact:

Nicholas Baeth, F&M

nicholas.baeth@fandm.edu

(717) 358-4541

Baoling Ma, MU

Baoling.Ma@millersville.edu

(717) 871-4263

Erin Moss, MU

Erin.Moss@millersville.edu

(717) 871-5903

Iwan Praton, F&M

iwan.praton@fandm.edu

(717) 358-4238