Mathematics Colloquium

Novel Challenges in Nonlinear Waves: Theory and Computation

Efstathios (Stathis) Charalampidis
Department of Mathematics
Cal Poly, SLO

Friday, November 19, 2021
4:10 – 5 p.m.
Building 180 Room 112

Abstract

In this talk, we will explore nonlinear wave phenomena motivated by experiments associated with Nobel-Prize winning area of Bose-Einstein Condensates (2001 Nobel Prize in Physics) as well as optical systems and water waves. The principal vehicle for our exploration will be the nonlinear Schrödinger (NLS) equation and variants thereof. Upon examining its properties, we will offer a diverse palette of computational techniques for the exploration of its configuration space, including fixed-point methods, continuation techniques (i.e. computational procedures for tracing out branches of solutions) as well as eigenvalue solvers for performing spectral stability analysis of the solutions found. Through their use, we will present novel coherent structures that had not been reported before and discuss bifurcations involving such states. If time permits, a discussion about ongoing work and timely challenges in these systems will be offered too.

About the speaker: Efstathios (Stathis) Charalampidis is currently an Assistant Professor in the Mathematics Department at Cal Poly San Luis Obispo. His research focuses on studies of complex systems originating from problems in mathematical physics, condensed matter physics, materials science, and fluid mechanics. Specifically, he has been developing analytical and computational techniques for studying the existence, stability and spatio-temporal evolution of nonlinear waves in a broad spectrum of applications, ranging from dynamical systems describing the formation of solitary patterns in materials science to matter waves in Bose-Einstein condensates and rogue waves. Before joining Cal Poly, he was a Lecturer and Chief Undergraduate Advisor for Mathematics majors (2018-2019), Visiting Assistant Professor (2015-2018) and Postdoctoral Research Associate (2013-2015) at UMass Amherst in the group of Professor Panayotis Kevrekidis. Stathis earned his Ph.D. in Applied Mathematics from the Department of Mathematical, Physical and Computational Sciences at Aristotle University of Thessaloniki, Greece. His Ph.D. dissertation, entitled "Skyrmions, Topology and Geometry", focused on analytical and numerical studies of localized lumps of energy in nuclear physics and Einstein's theory of gravitation.