ALPEN-ADRIA UNIVERSITÄT KLAGENFURT

INVITATION TO THE DOCTORAL SEMINAR

Benjamin Rainer
Universität Klagenfurt

"The periodic nonlinear Westervelt equation: Well-posedness, numerical solutions and the saturation effect"

N.2.35 | Wednesday, 7 January 2026 | 10:45 a.m.

Abstract
The nonlinear Westervelt equation is a widely used model for nonlinear acoustic wave propagation and is particularly relevant in modern ultrasound imaging, where nonlinear effects are exploited to enhance image quality. In this talk, we study a periodic version of the Westervelt equation with localized excitations and Robin boundary conditions in two and three space dimensions. We begin with a brief discussion of well-posedness, both in the linear and nonlinear settings, allowing for spatially varying coefficients that naturally arise in quantitative imaging applications. We then introduce a multiharmonic formulation that captures the generation of higher harmonics due to nonlinear wave propagation. Finally, we present numerical results based on a finite element discretization of the resulting Helmholtz system, illustrating nonlinear acoustic wave propagation and highlighting the saturation effect.

Barbara Kaltenbacher and the Department of Mathematics look forward to seeing you at the talk!