

Inverse problems for wave equations with generalized fractional derivatives

Summary

Study of inverse problems to determine inhomogeneities of media whose motion is governed by wave equations involving generalized fractional derivatives in principal terms.

Research field:	Earth sciences
Supervisor:	Jaan Janno
Availability:	This position is available.
Offered by:	School of Science Department of Cybernetics
Application deadline:	Applications are accepted between September 01, 2021 00:00 and September 30, 2021 23:59 (Europe/Zurich)

Description

Acoustic waves are used in seismic tomography and nondestructive testing of solids and materials. Many materials and media have attenuating or other complex properties that disfigure wave profiles (e.g. soil, viscoelastic materials, disordered materials). Wave processes in such media are described by equations involving nonlocal terms in time and/or in space. Nonlocal terms may be fractional derivatives or their generalizations (e.g. distributed fractional derivatives, tempered fractional derivatives). Generalized fractional derivatives include more degrees of freedom, therefore they enable more exact modelling of wave dynamics. Problems to determine inhomogeneities of nonlocal media by means of boundary measurements of wave characteristics are scarcely studied. Results are available in cases the equations contain non-local lower order terms or usual fractional derivatives in principal terms. The aim of the PhD project is to study inverse problems to determine inhomogeneities of media whose motion is governed by wave equations involving generalized fractional derivatives in principal terms. The investigation will contain both theoretical study (existence, uniqueness and stability of solutions) and development of effective numerical solvers. However, depending on the background and/or preferences of the student, the main focus of the research can be either theory or numerics.

Responsibilities and tasks of the PhD student:

- investigation of inverse problems
- collaboration with other scientists of a research group
- publishing results of the research in scientific journals
- presenting the results in scientific conferences and seminars
- participation in other working activities of the group (e.g., organization of conferences)
- writing and defending PhD thesis within 4 (+1) years

Applicants should fulfil the following requirements:

- master's degree in mathematics, physics or a related field
- good knowledge about partial differential equations and numerical methods



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