

Mini-Workshop “Analysis of PDEs”
March 27th - March 31st, 2023

11:30 - 12:30 am, Friday, March 31st 2023
Seminar room: SR 1.067, Math Building 20.30

Computer-assisted existence and multiplicity proofs for semilinear elliptic boundary value problems

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Abstract

Many boundary value problems for semilinear elliptic partial differential equations allow very stable numerical computation of approximate solutions, but are still lacking analytical existence proofs. In the talk, a method is proposed which exploits the knowledge of a „good“ numerical approximate solution in order to provide a rigorous proof of existence of an exact solution close to the approximate one. This goal is achieved by a Newton-Kantorovich-type fixed-point argument which takes all numerical errors into account, and thus gives a mathematical proof which is not „worse“ than any purely analytical one. The method is used to prove existence and multiplicity statements for many specific examples of boundary value problems on bounded and on unbounded domains, including cases where purely analytical methods had not been successful.