Computer-assisted proofs for periodic orbits of PDEs

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In this talk, we introduce a computer-assisted technique for the analysis of periodic orbits of PDEs. The idea is to use a Newton-Kantorovich type argument (the radii polynomial approach) to obtain rigorous proofs of existence of the periodic orbits in a weighted ell-one Banach space of space-time Fourier coefficients with geometric decay. As a first application, our proposed method is applied to prove existence of periodic orbits in the Kuramoto-Sivashinsky PDE, which is a popular model to study spatiotemporal chaos. A second application is to prove existence of periodic orbits in the Boussinesq equation, which has been investigated extensively because of its role in the theory of shallow water waves.

This is joint work with Roberto Castelli (VU Amsterdam, Netherlands), Jordi-Lluís Figueras (Uppsala, Sweden), Marcio Gameiro (USP, Brazil) and Rafael de la Llave (Georgia Tech, USA).