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Computer-assisted proof of Hopf bifurcation in functional differential equations of mixed type

I will present a computational approach to Hopf bifurcation verification for functional differential equations of mixed type. The verification of a steady state, imaginary eigenvalues and their transversality amounts to a finite-dimensional problem which we rigorously solve using a Newton-Kantorovich-type theorem. To prove the imaginary eigenvalues are simple and that there is no resonance, we use some a priori estimates and rigorous contour integration of the characteristic equation to count all eigenvalues in a neighbourhood of the imaginary axis. As an application, we prove some results on periodic traveling waves in the Fisher equation with a nonlocal reaction term. This is joint with with Jean-Philippe Lessard.