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NEW PROSPECTS FOR THE NUMERICAL BIFURCATION ANALYSIS OF NONLINEAR DELAY EQUATIONS

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Physiologically structured populations are often described by mathematical models where a renewal equation for the birth rate is coupled with a delay differential equation for the environmental variable. These equations generate dynamical systems on an infinite-dimensional function space.

In order to study numerically the bifurcation properties when varying some parameters, we apply the pseudospectral discretization technique to the infinite-dimensional system and obtain a finite-dimensional system of ordinary differential equations. The discretized system is easy to write from the original equation and ensures high-accuracy approximations with low system dimension, thanks to the spectral convergence properties of the approximation scheme. Finally, the bifurcation properties of the approximating system can be numerically studied with standard software for ODEs, with no need of developing tailor-made software for delay equations.

This procedure has proved to be effective on systems with finite delay [1, 2]. With some examples I will show that, with a suitable choice of the discretization nodes and the interpolation scheme, the procedure is effective also on equations where the delay is infinite.

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