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Numerical bifurcation analysis of delay differential equations basic software: DDE-BIFTOOL and PDDE-CONT

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Abstract

We give an introduction to numerical methods for the stability and bifurcation analysis of systems of delay differential equations (DDEs). Compared with numerical methods for such tasks in ordinary differential equations, these methods are either similar, but with a higher computational cost (e.g. collocation for computing periodic solutions) or much complex (e.g. computing stability of a steady state, computing a connected orbit). This is due to the infinite-dimensional nature of DDEs. We describe the capabilities of two software packages: DDE-BIFTOOL and PDDE-CONT. DDE-BIFTOOL is a Matlab package for continuation and bifurcation analysis of steady state and periodic solutions of DDEs. Also connecting (homoclinic and heteroclinic) orbits can be computed. PDDE-CONT is an C++ package for the continuation and bifurcation analysis of periodic solutions of DDEs. Both packages will be demonstrated and during the practical session hands-on experience can be obtained.