Numerical continuation for delay equations—beyond DDE-BIFTOOL

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Abstract

Numerical continuation for DDEs with constant or explicit state-dependent delays has been possible for several years with DDE-BIFTOOL and more recently with PDDE-CONT. However, there are other types of systems with delay that arise in applications and do not fall into these two classes. This demonstration will showcase two new bifurcation tools that can deal with neutral DDEs and piecewise-smooth DDEs respectively. The implementations are extensions of DDE-BIFTOOL and will be demonstrated with two concrete applications: a neutral delay model of a transmission line oscillator and a piecewise-smooth model of metal cutting. As an outlook to the future, we will discuss preliminary work on bifurcation analysis for PDEs with delay and also for systems with implicit state-dependent delays.