TIME DELAY SYSTEMS

Webinar

TDS

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Hopf Bifurcation Made Simple for Some Scalar Delay Differential Equations

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7:00 am (PDT), 10:00 am (EDT), 10:00 pm (CST)

Event will take place via Zoom

ABSTRACT: Delay induced Hopf bifurcation is a typical phenomenon for nonlinear delay differential equations. It can be detected by analyzing the characteristic equation of the linearization around a steady state. However, determining the criticality of the bifurcation (i.e. it is sub- or supercritical) is much more complicated, requires higher order terms and hugely cumbersome calculations. In this talk we show that for a particular class of scalar delay differential equations, that includes for example the delayed logistic equation as well, the criticality of Hopf bifurcations reduces to a very simple condition and we do not have to to calculate the complicated first Lyapunov coefficient, which is usually needed. Then we characterize all possible bifurcation sequences as we increase the delay. Moreover, lower and upper estimates are given for the period of the bifurcating periodic solutions. We also show that for a prototype model of population dynamics, the Nicholson's blowfly equation, all Hopf bifurcations are supercritical. This is a joint work with István Balázs.

BIO: Dr. Gergely Röst is a mathematician at the Bolyai Institute of the University of Szeged in Hungary, with main research areas in nonlinear dynamics, differential equations, mathematical epidemiology, and mathematical biology. He earned his honors degree in mathematics at the University of Szeged, where he also defended his PhD with a Golden Ring of Hungary (highest academic achievement in the country, delivered by the President) in the field of nonlinear delay differential equations. He spent a year at Justus Liebig University in Giessen, Germany, and, after completing his studies in Szeged, moved to Toronto for postdoctoral research to work in the team of Professor Jianhong Wu. During this time, he began working on the mathematical modeling of epidemics as part of a major interdisciplinary network in Canada. He has also worked as a researcher at Arizona State University and the University of Oxford but has always returned to Szeged, Hungary. In 2010, with the support of the European Research Council, he established the first mathematical epidemiology research group in the Central-Eastern European region at the University of Szeged, which has been operating successfully ever since. In 2020, he was involved at the highest level in the fight against the coronavirus pandemic, being head of the National Task Force and key scientific advisor to the Prime Minister. Since 2022, he has been the scientific director of the National Laboratory for Health Security.

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