The Center for Control, Dynamical Systems, and Computation
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Presents

Continuation of Periodic Solutions in an Experiment

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Abstract:

When a mathematical model is available, for example, in the form of a system of ordinary differential equations, then it is possible to find and follow equilibria, periodic solutions and their bifurcations in system parameters. Numerical continuation is today a well-established tool that is implemented in software packages such as AUTO, DsTool and Content. However, in many situations it is impractical or even intractable to derive a mathematical model of the system under consideration. Particular examples are hybrid engineering tests, where a test specimen of interest (for example, a bridge cable) is tested in the laboratory as if it were part of the entire structure (the bridge). To this end, the tested part is coupled dynamically via sensors and actuators to a computer simulation of the remainder of the structure (such as the bridge deck). The talk presents a continuation method that enables one to continue branches of solutions, including periodic orbits, directly in an experiment. A control-based setup in combination with Newton iterations ensures that the periodic orbit can be continued even when it is unstable. Our method is demonstrated with the continuation of initially stable rotations of a vertically forced pendulum experiment through a fold bifurcation to find the unstable part of the branch. Joint work with Jan Sieber - University of Portsmouth, Alicia Gonzalez-Buelga, Simon Neild and David Wagg - University of Bristol.

About the Speaker:

Bernd Krauskopf is Professor of Applied Nonlinear Mathematics at the Department of Engineering Mathematics, University of Bristol. He obtained his PhD in Mathematics in 1995 from the University of Groningen, Netherlands. After Postdoctoral Fellowships at Cornell University and Vrije Universiteit Amsterdam, he joined the University of Bristol in 1998 as a lecturer. Bernd Krauskopf has been EPSRC Advanced Research Fellow in the period 2001-2006 and was promoted to full professor in 2003. His research interests lie in theory and methods for dynamical systems and their applications, in particular, to laser systems, aircraft ground dynamics and hybrid experimental tests.