GREG REID, University of Western Ontario, London, Ontario
Stable numerical-geometric approaches for differential algebraic equations

This is the first of two talks about stable numeric-geometric methods for general systems of differential equations with constraints (so-called differential-algebraic equations or DAE). Such systems are attracting much attention since they are automatically generated by computer modeling environments such as MapleSim. Determination of such constraints is essential for the determination of consistent initial conditions and the numerical solution of such systems. This talk will concentrate on introduction of concepts from the (Jet) geometry of differential equations, illustrated by visualizations and simple examples. A subsequent talk by Niloofar Mani, will discuss initial investigations that we have made using MapleSim, and such approaches.

This talk will be an introduction to stable numerical methods for such general systems. The corresponding problem for the non-differential case, that of approximate polynomial systems, has only recently been given a solution, through the works of Sommese, Wampler and others. The new area called numerical algebraic geometry, will also be described. Key data structures are certain witness points on jet manifolds of solutions, computed by stable homotopy continuation methods.