Real solution of DAE and PDAE System

Zahra Mohammadi, Greg Reid

Abstract

General systems of differential equations don't have restrictions on the number or type of equations. For example they can be over or under-determined, and also contain algebraic constraints (e.g. algebraic equations such as in Differential Algebraic equations (DAE) and Partial differential algebraic equations (PDAE)). Increasingly such general systems arise from mathematical modeling of engineering and science problems such as in multibody mechanics, electrical circuit design, optimal control, chemical kinetics and chemical control systems. In most applications, only real solutions are of interest, rather than complex-valued solutions.

Much progress has been made in exact differential elimination methods, which enable characterization of all hidden constraints of such general systems, by differentiating them until missing constraints are obtained by elimination. A major problem in these approaches is related to the exploding size of the differentiated systems.

Due to the importance of these problems, we outline a Symbolic-Numeric Method to find at least one real point on each connected component of the solutions set of such systems.