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Investigation of Different Conditions to Detect Cycles in Linearly Implicit Quantized State Systems

Authors : Elmongi Elbellili, Ben Lauwens, Daan Huybrechs

Abstract : The increasing complexity of modern engineering systems presents a challenge to the digital simulation of these systems which usually can be represented by differential equations. The Linearly Implicit Quantized State System (LIQSS) offers an alternative approach to traditional numerical integration techniques for solving Ordinary Differential Equations (ODEs). This method proved effective for handling discontinuous and large stiff systems. However, the inherent discrete nature of LIQSS may introduce oscillations that result in unnecessary computational steps. The current oscillation detection mechanism relies on a condition that checks the significance of the derivatives, but it could be further improved. This paper describes a different cycle detection mechanism and presents the outcomes using LIQSS order one in simulating the Advection Diffusion problem. The efficiency of this new cycle detection mechanism is verified by comparing the performance of the current solver against the new version as well as a reference solution using a Runge-Kutta method of order14.

Keywords : numerical integration, quantized state systems, ordinary differential equations, stiffness, cycle detection, simulation
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