Partitioned Rosenbrock methods for multibody systems in descriptor form

Jörg Wensch

Institut fuer Numerische Mathematik, FB Mathematik und Informatik
Martin-Luther-Universitẗ Halle-Wittenberg, D-06099 Halle, Germany

In the last years remarkable effort has been made to develop time integrators for index 1 and index 2 differential algebraic systems. Here the time integration of mechanical multibody systems in index 3 formulation by Rosenbrock methods is investigated. The special class of Rosenbrock methods is partitioned in two ways – coefficient partitioning and partitioning of the jacobian is used. Convergence is proved.

The construction of such methods is a difficult task. There are 292 order conditions to be satisfied for order 4. A method of order 4 with 11 stages has been computed numerically. Further, a set of simplifying assumptions is given that allows to reduce the number of order conditions rapidly down to 40. For methods with 8 stages or more the solution of these 40 equations can be given explicitly. A method with 8 stages is constructed.

The method with 8 stages is implemented in the code PROWMBS4. The Rosenbrock methods with 8 and 11 stages are compared with the RADAU code, applied on index 3, and with HEM5, which is applied on index 2. Andrews squeezing mechanism is used as test example. The numerical tests show that the ROW method is reliable and efficient on index 3.