Summary: We present a new method for the nonlinear approximation of the solution manifolds of parameterized nonlinear evolution problems, in particular in hyperbolic regimes with moving discontinuities. Given the action of a Lie group on the solution space, the original problem is reformulated as a partial differential algebraic equation system by decomposing the solution into a group component and a spatial shape component, imposing appropriate algebraic constraints on the decomposition. The system is then projected onto a reduced basis space. We show that efficient online evaluation of the scheme is possible and study a numerical example showing its strongly improved performance in comparison to a scheme without freezing.

MSC:
65M08 Finite volume methods for initial value and initial-boundary value problems involving PDEs
35Q53 KdV equations (Korteweg-de Vries equations)

Keywords:
Burgers equation; method of freezing; finite volume method; nonlinear evolution problems; hyperbolic regimes; moving discontinuities; partial differential algebraic equation; numerical example

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References:

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