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GLOBAL DISCRETE EMPIRICAL INTERPOLATION METHOD FOR NONLINEAR MODEL ORDER REDUCTION

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In the context of model order reduction (MOR) for nonlinear problems, we propose a variant of discrete empirical interpolation method (DEIM), called global DEIM (GDEIM). Since DEIM is a nearly-optimal method, i.e., the error of the reduction depends on the number and location of the selected nonlinearities to evaluate, we show that, by employing an alternative procedure to select the points, we sometimes obtain a better accuracy of the reduction with GDEIM for the same number of points as for DEIM. This is useful especially when one has restrictions on the dimension of the reduced order model (ROM) to simulate or, the other way around, when a better accuracy can be reached for a speci ed reduction order. To compare the accuracy level between GDEIM and DEIM before proceeding with the reduction, i.e., when the projection matrix is formed, we make use of a heuristic error estimator cheap to evaluate, which in most of our experiments is able to determine which of the two methods is best. This can speedup simulations of the obtained ROM, when inputs and/or parameters are swept for analysis. We demonstrate the usefulness of GDEIM to nonlinear, parametric, analytic functions and provide a comparison with DEIM by using our error estimator. The second contribution of this work is a mathematical formulation which extends (G)DEIM to general nonlinear function, evaluated non-componentwise. We provide accuracy and speedup results from using our extended formulation to an example for time-domain circuit simulation, described by a set of dierential algebraic equations. This may be a promising direction to speedup analysis of more complex and large circuits, where it is common to have millions of unknowns in the vector-solution.