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DEIM-spirited hypred reduction for nonlinear constraint projectiond

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We introduce a novel reduction bases to accelerate the nonlinear term evaluation of constraints projections on different mesh elements. Our method determines an approximate reduced subspace that is computed on the constrained elements (vertices, triangles, tetrahedrons) which show the largest deformation on the provided set training snapshots. We achieve low error bounds by incorporating the differential operator that maps constrained projections to position space and use a discrete empirical interpolation to determine a small set of interpolation elements which then can be used instead of full elements dimension in order to internal forces computation. Our method works with any mesh. We compare to the state of are using linear-blend skinning for the same purpose and show lower ranges of relative norm errors and rotations, our results show high computational efficiency, stability using much smaller subspace dimension as well as constrained elements.

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