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A nonlinear reduced basis approximation of discrete contact problems in crowd motion

In this work we adapt recent model reduction approaches to predict the solutions of time-dependent parametrized problems describing crowd motion in the presence of obstacles. The problem of interest is a discrete contact model, which is formulated as a constrained least-squares optimization statement. The parametric variations in the problem (associated with the geometric configuration of the system and with the initial positions of the particles) have a dramatic impact in the solution, both in terms of positions and contact forces, which are represented by the Lagrange multipliers of the underling saddle-point problem. Motivated by a slow decay of the Kolmogorov n-width, we investigate new developments and combinations of the reduced-basis method and supervised machine-learning techniques to effectively estimate primal and dual solutions. The proposed nonlinear compressive strategy is numerically validated by comparisons with more standard linear and nonlinear approximations.

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