An adaptive projection-based model reduction method for nonlinear mechanics with internal variables: application to thermo-hydro-mechanical systems

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We propose a projection-based model order reduction (MOR) procedure for a class of problems in nonlinear mechanics with internal variables. The work is is motivated by applications to thermo-hydro-mechanical (THM) systems for radioactive waste disposal. THM equations model the behaviour of temperature, pore water pressure and solid displacement in the neighborhood of geological repositories, which contain radioactive waste and are responsible for a significant thermal flux towards the Earth's surface. We develop an adaptive sampling strategy based on the POD-Greedy method, and we develop an element-wise empirical quadrature hyper-reduction procedure to reduce assembling costs. We present numerical results for a two-dimensional THM system to illustrate and validate the proposed methodology. We further discuss the extension to component-based MOR to deal with high-dimensional parametrizations and changes in domain topology.

REFERENCES

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