Adaptive trust-region POD for optimal control of the Cahn-Hilliard equation

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We consider the optimal control of a Cahn-Hilliard system in a trust-region framework. For an efficient numerical solution, the expensive high dimensional PDE systems are replaced by reduced order models utilizing proper orthogonal decomposition (POD-ROM). Within the trust-region POD (TR-POD), the accuracy of the surrogate models is controlled in the course of the optimization. The POD modes are computed corresponding to snapshots of the governing equations which are discretized utilizing adaptive finite elements. Different types of snapshots and POD basis generations for the different system variables are analyzed. In the numerical examples, the smooth as well as the double-obstacle free energy potential are considered.