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An Efficient Solution Strategy for Variational Models of Brittle Fracture

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There is an increasing interest in solvers for phase-field models of brittle fracture [2]. The governing equations for this problem originate from a constrained minimization of a non-convex energy functional, and the most commonly used solver is a staggered scheme. This method shows robustness in comparison to the monolithic Newton method, however, the staggered scheme often requires many iterations to converge when fractures are evolving. The focus of our work is to accelerate the solver through a scheme that combines Anderson acceleration and over-relaxation. The method is applied as a post-processing technique, and therefore, already available software can be modified to include the acceleration method. Moreover, the activation of the scheme has a negligible cost. A numerical study, including well-known benchmark problems, that demonstrates the efficiency, and robustness of the method will be presented [1].

[1] Storvik, E., Both, J.W., Sargado, J.M., Nordbotten, J.M. and Radu, F.A. An accelerated staggered scheme for phase-field modeling of brittle fracture. arXiv:2008.11787 [math.NA] (2020).

[2] Brun, M.K., Wick, T., Berre, I., Nordbotten, J.M. and Radu, F.A. An iterative staggered scheme for phase field brittle fracture
propagation with stabilizing parameters Comput. Methods Appl. Mech. Engrg. 361 (2020) https://doi.org/10.1016/j.cma.2019.112752.

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References

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