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Laser shock simulations in 3D CFRP laminates

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This work deals with a numerical method for solving wave propagation problems in anisotropic media with the Proper Generalized Decomposition (PGD). In contrast to existing applications of the PGD in elastodynamics, the separation of variables is here applied to phase variables instead of variables in space and time [1, 2]. The computation in time is tackled incrementally with an explicit time integration scheme as in [3], leading to a wave propagation friendly version of the PGD. The spatial discretization is performed with the spectral element method to increase the spatial resolution and reduce the computation time. This formulation aims at reducing both the computation time and the memory consumption with respect to similar time incremental strategies using the finite element method.

The proposed technique is applied to 3D transient elastodynamic problems inspired from laser shock configurations in CFRP laminates [4]. Numerical results demonstrate that this new version of the PGD successfully captures wave propagation phenomena with satisfactory numerical performances. The convergence properties of the algorithm are presented and the results are compared to reference solutions.

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