LATIN approach for fatigue damage computation

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Non-linear mechanical behaviour such as (visco)plasticity or damage is generally tackled with time incremental methods where the time domain is subdivided into incremental steps. Then a numerical scheme is carried out consequently for each time step. In contrast, in LArge Time INcrement (LATIN) method [1], an approximation of the total time history process is sought directly. This is done by an iterative sequence of two steps: tackling the global linear mechanical equilibrium equation on one side, and on the other one the local history process is determined. The global stage can benefit from model reduction techniques such as the proper generalised decomposition (PGD), in order to obtain a substantial reduction of the computational cost. Moreover, for parametric problems, efficient reduced models can easily be derived.

The LATIN method has been well established to compute several types of problems including material non-linearities [2] but has not been extended to unilateral damage law which leads to a non-linear state equation. An extension of the method is then introduced herein to tackle this issue and then to benefit from a promising numerical framework for fatigue damage computation.

[1] P. Ladevèze, *Nonlinear computational structural mechanics: new approaches and non-incremental methods of calculation.* New York, NY: Springer New York, 1999.

[2] P. Ladevèze, "On reduced models in nonlinear solid mechanics," *European Journal of Mechanics - A/Solids*, vol. 60, pp. 227 - 237, 2016.

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