6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 – 15 June 2018, Glasgow, UK

MODEL ORDER REDUCTION FOR NONLINEAR PROBLEMS INVOLVING COMPLEX TIME-VARYING LOADINGS

Pierre Ladevèze, David Néron

LMT (ENS, CNRS, Université Paris-Saclay)
61 avenue du Président Wilson, 94230 Cachan, France
{ladeveze,neron}@lmt.ens-cachan.fr

Key Words: *Model Reduction, Nonlinear Problems.*

The simulation of the nonlinear mechanical response of structures subjected to fatigue cyclic loadings for a large number of cycles or to seismic loadings, i.e. complex varying loadings, remains a challenge. The goal of this work is to develop a dedicated computational scheme for such complex loadings in problems involving nonlinear material behaviours described by internal variables.

The focus is on the Large Time Increment (LATIN) method coupled with the PGD model reduction technique. This method has already been introduced in the 90s for fatigue cyclic loadings and revisited recently with a new version, more robust taking in particular into account the progress made recently. More, unilateral damage was considered.

Here, we go further considering more complex time varying loadings which are not necessarily periodic. In that scheme, a two-time-multiscale approach is proposed. It consists for the quantities of interest in computing only the "nodal cycles" associated to the nodal "macro" time steps and using a suitable "macro" interpolation to describe their evolution at the "macro" time scale. The proposed method is exemplified for a structure subjected to visco-plasticity and damage; two kinds of loadings are studied: fatigue loadings and seismic loadings. It leads to a drastic reduction of the numerical cost, and to a new generation of engineering reduced models.