

# REAL-TIME DIRECT INTEGRATION OF (HYPER-)ELASTODYNAMICS BY PGD TECHNIQUES

David González<sup>1</sup>, Elías Cueto<sup>2</sup> and Francisco Chinesta<sup>3</sup>

<sup>1</sup> Aragon Institute of Engineering Research. Universidad de Zaragoza, Spain. gonzal@unizar.es

<sup>2</sup> Aragon Institute of Engineering Research. Universidad de Zaragoza, Spain. ecueto@unizar.es

<sup>3</sup> Ecole Centrale de Nantes, France. francisco.chinesta@ec-nantes.fr

**Key words:** *Real-Time, Proper Generalized Decomposition, Model Order Reduction, Hyper - ElastoDynamics.*

In this work, we propose a new method for the real-time direct integration of reformulated solid dynamics equations in a multidimensional form. Using a model order reduction technique, like Proper Generalized Decomposition (PGD), and with a traditional discretization in time of dynamics equations, a very efficient method is obtained.

In an off-line stage, we pre-compute a meta-model of the system for any initial values and for any type of force. With this PGD solution we obtain the system response for very large time intervals without lost of accuracy and in a real time (on-line stage).

In addition to the technique proposed, a combination methodology between POD-PGD to alleviate the degrees of freedom is used in this work.

In order to show the behaviour of the technique several examples are studied, focused on the number of modes of the POD approximation used, for optimal accuracy.