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Reduced-order modeling methods for the construction of virtual charts in nonlinear dynamics

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Being able to predict the robustness of a structure to a wide range of unknown solicitations is a key element, in particular in civil engineering. To that aim, it is often needed to assess the probability of failure over a given parametric space. Doing so may result in costly numerical simulations as it requires the computation of numerous nonlinear dynamics problems. Indeed, it is then necessary to carry out calculations up to the ruin of the structure and thus to take into account a nonlinear material behavior [2].

To decrease the numerical cost of such a prediction a strategy based on the combined use of metamodels and reduced order modeling techniques will be presented. The showcased methodology allows to get a cost effective estimation of the probability of failure of the studied structure that will be wisely computed using the LATIN-PGD jointly with metamodeling techniques [3]. The LATIN method [1] allows the use of the *Proper Generalized Decomposition* (PGD) which is an a priori reduced-order modeling technique, while the use of a metamodel leads to a significant drop in the number of nonlinear computations needed.

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