First Journal Publications from the ALPES Project

The first journal publications from ALPES researchers have now been published by Michele Castellani and Irene Tartaruga.

Michele Castellani, Yves Lemmens, Jonathan E Cooper

Parametric reduced-order model approach for simulation and optimization of aeroelastic systems with structural nonlinearities.

Proceedings of the Institution of Mechanical Engineers, Part G: Journal of Aerospace Engineering, first published on October 8, 2015 as doi:10.1177/0954410015608888

Abstract

A method based on parametric reduced-order models to efficiently predict the transient response of aeroelastic systems with concentrated structural nonlinearities is presented. The approach approximates the nonlinear response in a piecewise-linear manner through time integration of sub-linear reduced-order models; these are parameterized with respect to the nonlinearity and are efficiently obtained by balanced truncation and interpolation. The procedure is applied to the optimization of a wing tip device for passive loads alleviation which features a nonlinear stiffness, showing the effectiveness and efficiency of the methodology.

Irene Tartaruga, Jonathan E Cooper, Mark H Lowenberg, Pia Sartor, Simon Coggon, Yves Lemmens

Prediction and uncertainty propagation of correlated time-varying quantities using surrogate models

CEAS Aeronautical Journal pp 1-14 First online: 22 October 2015

Abstract

The identification of correlated quantities is of particular interest in several fields of engineering and physics, for example in the development of reliable structural designs. When ‘time-varying’ quantities are analysed, pairs of correlated interesting quantities (IQs), e.g. bending moments, torques, etc., can be displayed by plotting them against each other, and the critical conditions determined by the extreme values of the envelope (convex hull). In this paper, a reduced order singular value-based modelling technique is developed that enables a fast computation of the correlated loads envelope for systems where the effect of variation of design parameters needs to be considered. The approach is extended to efficiently quantify the effects of uncertainty in the system parameters. The effectiveness of the method is demonstrated by consideration of the gust loads occurring from the aeroelastic numerical model of a civil jet airliner.