Talk Announcement

Wednesday, April 17th, 2024, 11:00 am

Prof. Alessandra Vizzaccaro

(College of Engineering, Mathematics and Physical Sciences, University of Exeter)

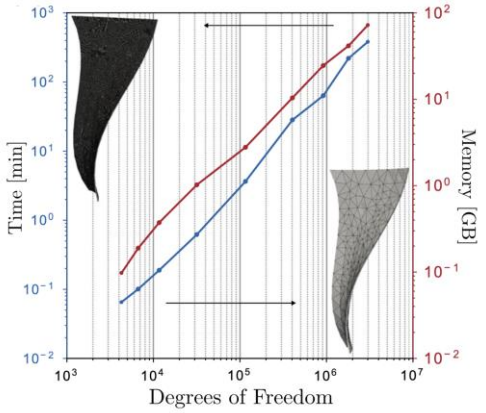
will give the talk

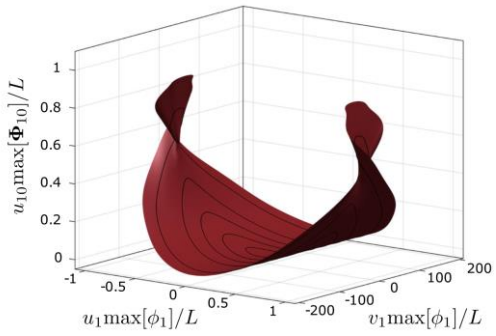
Invariant Manifold Parametrisation of Nonlinear Structures Modelled with Large Finite Element Models

Abstract. The purpose of Model Order Reduction (MOR) is to identify patterns and use them to decrease the number of dimensions of a problem as much as possible. Slow invariant manifolds are low dimensional objects that attract the dynamics from the fast scale, making them the best candidate for a reduced order model of a wide range of large dimensional systems.

In this contribution we present a method to compute asymptotic expansion of slow invariant manifolds of large finite element models and their reduced-order dynamics on the manifold. We show the accuracy of the reduction on selected models, exhibiting large rotations and internal resonances. The results obtained with the reduction are compared to full-order harmonic balance simulations obtained by continuation of the forced response.

We also illustrate the low computational cost of the proposed implementation for increasing order of the asymptotic expansion and increasing number of degrees of freedom in the structure. The results presented show that the proposed methodology can reproduce extremely accurately the dynamics of the systems with a very low computational cost.





Bio: Alessandra obtained her PhD in 2021 at Imperial College London, sponsored by Rolls Royce PLC, in computational nonlinear dynamics, with focus on vibration in aircraft engines. Later, she joined the University of Bristol as a Research Fellow in Engineering Mathematics under the DigiTwin programme grant, where she developed new experimental techniques for digital twins. She is now a Senior Lecturer in the Data Centric Engineering group at the University of Exeter, working on probabilistic model order reduction and physics informed surrogate modelling.

Her research lives at the intersection between applied mathematics and engineering and aims at developing novel tools to address real-world industrial challenges. Her major contribution is in the field of dimensionality reduction of large-scale numerical models, with application ranging from aerospace structures to MEMS devices.