Topic: Non-Intrusive Reduced Order Models for Computational Aeroservoelasticity and Wave-Structure Interaction Problems

Date and Time: 30th April 2021, Friday, 11.30 am (9.30 am GMT)

Speaker: Dr. Rahul Halder

Abstract: Reduced-order modelling has played a significant role in computational aeroelasticity and has been effective for facilitating quick prediction of flutter, gust load, limit cycle oscillation (LCO), shape optimization, uncertainty propagation, aeroservoelastic control, and various other issues which influence aircraft design. A high fidelity aeroelasticity solver has been developed in the SU2 platform (an open-source CFD solver) for both the full order aeroelastic model and the training signals computation for the Reduced Order Model (ROM). A novel signal interpolation-based parametric linear non-intrusive reduced order model will be presented for the quick prediction of the flutter instabilities and gust load over Mach Number variation. A long short-term memory-based deep learning model has been coupled with the Discrete Empirical Interpolation Method (DEIM-LSTM) for the quick prediction of aerodynamic load under structural and continuous gust load excitation. The application of the developed reduced order models will be discussed in the context of aeroservoleastic control of a high aspect ratio wing. The speaker has developed a novel Physics Informed LSTM network with an improved loss function for the application of two degrees of freedom mass-spring system. The speaker will also discuss the DEIM-LSTM network for the application of the wave-structure interaction problems where the training dataset is generated using an open-source smooth particle hydrodynamics (*sph*) solver DualPhysics.

About the Speaker: The speaker is currently a research scientist in Temasek Laboratory, National University of Singapore. He has done his Masters degree at the Indian Institute of Technology, Madras in India, and a Ph.D. from the National University of Singapore. His research interests are the application of reduced-order modelling and scientific machine learning for the fluid-structure interaction problems in aerospace , offshore, and other engineering areas.