

Ciclo di seminari del Dr. Pranay Seshadri (University of Cambridge)

Si informano tutti i colleghi e gli studenti interessati che, nell'ambito del **programma Visiting Professor 2017**, finanziato dalla Regione Autonoma della Sardegna, il **Dr. Pranay Seshadri**, Research Fellow presso l'Università di Cambridge, terrà due seminari sull'utilizzo della fluidodinamica numerica nella progettazione di motori aeronautici.

Giovedì 12 aprile 2018, ore 9 (aula 2, edificio N, Facoltà di Ingegneria, via Marengo 2, Cagliari)

Dimension Reduction in Turbomachinery

Blades in modern jet engines are parameterized by 20-300 design variables. It is impossible to visualize, and more importantly, effectively explore such vast design spaces. Yet such an exploration may be required not solely for optimization and uncertainty quantification endeavors, but more importantly, for understanding the physics that underpins key design characteristics. For instance, when carrying out an optimization, the designs that are often associated with high efficiency are likely to be different from those associated with high flow capacity and high pressure ratio. Likewise, designs that are insensitive to variations in operational boundary conditions are likely to be different from those that are sensitive under the very same conditions. So what is the physical rationale for different design characteristics and how do we identify them?

Our goal is to be able to identify key linear combinations of designs that influence certain outputs, especially when the total number of design variables is large. These salient concerns motivate an output-based—i.e., efficiency, flow capacity or pressure ratio—dimension reduction strategy. In this talk, a new algorithm for subspace-based dimension reduction is introduced. It combines manifold optimization with classical Gaussian process regression. The fundamental idea we exploit is that for many physics-driven problems, outputs can be expressed as a non-linear function of a few linear combinations of all the variables. We describe how the computed dimension reducing subspace can be used for optimization, uncertainty quantification and more importantly for gaining physical insight into turbomachinery fluid mechanics.

Lunedì 16 aprile 2018, ore 9 (aula AB, edificio I, Facoltà di Ingegneria, via Marengo 2, Cagliari)

Fan Aerodynamics

In this rather broad talk, we discuss the aerodynamic design challenges in fan blades. Fan blades sit at the front of modern turbofan engines and are responsible for delivering thrust and for providing flow to the core compressor. We begin with a quick overview of compressor triangles and supersonic flow principles, which sets the stage for in-depth understanding of fan 2D aerodynamics. One of the main metrics of performance we investigate here are compressor spikes—a measure of the diffusion across blade sections. This is followed by a discussion of fan 3D aerodynamics with a focus on tip flows and hub leakage flows. This talk is substantiated by a two computational studies carried out on a fan blades.

Short biography of Dr. Pranay Seshadri (<https://www-edc.eng.cam.ac.uk/people/ps583.html>)

Pranay Seshadri is a postdoctoral fellow at the Department of Engineering, University of Cambridge, where he also obtained his PhD in Engineering. His research interests span techniques for uncertainty quantification and optimization with a focus on problems in turbomachinery aerodynamic design and turbomachinery metrology. He teaches topics ranging from convex optimization and numerical linear algebra to thermofluid mechanics and fan design. His research has been funded by Rolls-Royce plc and EPSRC (Engineering and Physical Science Research Council).