Department of Systems Engineering and Engineering Management

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Seminar Series

The Roles of Computational Science in Efficient and Realistic Aircraft Design and Performance Analyses

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Date	20 June 2017 (Tuesday)
Time	10:30am - 11:30am
Venue	G5-316, 5/F, AC1

Abstract

At present, aerospace computation has gone beyond the computational fluid dynamics (CFD) and computational structural mechanics (CSM). One prominent example is the application of constrained optimization techniques to meet the desired design objective in aircraft design process, such as minimum drag, fuel burn, or structural weight. Using intensive computation for simulation and optimization allows researchers and practitioners to model and examine phenomena that are too complex, costly, and hazardous for experimentation, and thus address problems previously deemed intractable. Computational science also makes it possible to analyze the interdependency of processes across disciplinary boundaries. In this regard, multidisciplinary design and optimization (MDO) aims to assist the design analyses and optimizations of any complex systems while accounting for the interdisciplinary coupling within the system. MDO is therefore deemed suitable for the analysis and design processes of a system as complex as aircraft.

The complexity of an aircraft system makes its analysis and optimization procedures computationally expensive. Often, their performance is evaluated at just one nominal flight condition, while in reality we know that an aircraft must be able to operate efficiently at different flight conditions. In fact, a single-point analysis and optimization has the risk of performance degradation at other conditions. Addressing this problem

is critical and has been one of my research focuses. I believe that incorporating actual data into the analysis and optimization could help make the processes more realistic, such that the results would reflect how aircraft actually operate in real-world applications. This could be done, for instance, by employing machine learning techniques. Surrogate modeling techniques, which can approximate complex physics models with simpler mathematical expressions, would be useful in reducing the computational cost and time. In this talk I am going to briefly discuss about some of the examples.

About the Speaker

Prof. Rhea Liem is an Assistant Professor at the Department of Mechanical and Aerospace Engineering (MAE), Hong Kong University of Science and Technology (HKUST). Her research focuses on aerospace computation, i.e., using numerical techniques and computational methods to support aircraft design, mission analysis, and other aircraft performance evaluation procedures.

She obtained her Bachelor of Engineering degree from the School of Mechanical and Production Engineering, Nanyang Technological University (NTU), Singapore. Her undergraduate study was supported by the Association of Southeast Asian Nations (ASEAN) with a 4-year merit-based full scholarship. She earned Master of Science (S.M.) degrees in Computation for Design and Optimization (supported by the Singapore-MIT Alliance Fellowship Award), and Aeronautics/Astronautics, from the Massachusetts Institute of Technology (MIT). She then pursued her PhD degree in the Multidisciplinary Design Optimization (MDO) Laboratory, University of Toronto Institute for Aerospace Studies (UTIAS), as a Vanier Canada Graduate Scholar. She is also a 2012 Amelia Earhart Fellow.

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All are Welcome!

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