The 57th JUACEP Seminar

第57回名古屋大学日米加協働教育プログラムセミナー

10:30-12:00, Thursday, November 6, 2025

TEL Auditorium, 3F, EI Bldg.

（EI創発館3階 TELオーディトリアム）

"Structural Integrity of Aviation Gas Turbine Engines: Challenges and Opportunities"

Prof. Shaker A. Meguid

Ph.D., PEng., CEng, MCSME, FIMechE, FASME,FEIC, LTSM-AIAA

Mechanics and Aerospace Design Laboratory

University of Toronto Canada

Abstract

In this talk, Meguid will summarize some of his recent research on the structural integrity of aviation gas turbine engines. These include studies concerned with blade disc interface stresses, thermomechanical failures in thermal barrier coatings (TBCs), instability challenges in aerial refueling and multifunctional nanocomposites. This will be followed by an extended coverage of single and multiple blade shedding that could lead to catastrophic failures. These failures typically result from the severe operating conditions of the engine, poor blade design/manufacture maintenance, blade vibration, and foreign object damage. In spite of the strict design and certification requirements that are imposed on engine manufacturers by aviation authorities to ensure the safety of the engine, passengers and plane, uncontained blade shedding remains unresolved, as evidenced by the recent blade shedding incidents. Accordingly, Meguid will address three related topics: (i) identifying kinematic trajectory of the released blades both numerically using nonlinear finite element simulations and experimentally using a newly designed and instrumented scaled down test rig.. (ii) Determining the energy absorption and containment capabilities of a number of alternative materials. (iii) Finally, he will share his novel bilayer containment ring design accounting for the interaction between the released blade and the trailing blades in a fan disk.

Keywords: Gas Turbine Engines, Structural Integrity, Blade Shedding, TBCs, Aerial refueling Novel Containment Ring Design, Finite Element Simulation.

Biography

Shaker Meguid is the Director of the Mechanics and Aerospace Design Laboratory at the University of Toronto. With over 30 years of research experience, he has made significant contributions to aerospace and automotive engineering, fracture mechanics, and nanocomposites. He has published 320+ papers, delivered 250+ conference presentations, and authored or edited multiple books and proceedings. He is the Founding Editor-in-Chief of two scientific journals and has served on numerous editorial boards. Previously, he established the Aerospace Engineering Division at Nanyang Technological University in Singapore and has taught across four continents. His work includes consulting for the UN and collaborating with industry.

Professor Meguid is a Fellow of ASME, IMechE, and the Engineering Institute of Canada, and holds professional engineering titles in Canada and the UK. He has received multiple awards, including the 2023 EuraSEM Excellence Award for his contributions to experimental mechanics and engineering education.