THE WILLIAM E. BOEING DEPARTMENT OF
AERONAUTICS & ASTRONAUTICS

... welcomes ...

DR. CHARBEL FARHAT

STANFORD UNIVERSITY

A Renaissance of Fluid-Structure Interactions: From Linear to Highly Nonlinear Applications in Aerospace and Mechanical Engineering

Fluid-structure interactions are among the most important considerations when designing complex engineering systems such as aircraft, spacecraft, turbine blades, Formula 1 cars, and underwater vessels, to name only a few. They are also important for the analysis of aneurysms in large arteries and artificial heart valves. They can significantly affect performance and/or structural integrity. For several decades, attention has focused almost exclusively on the linear subclass of such interactions, or on their linearization for stability and control applications. A well-known example in the first case is the theory of elasto-acoustics that is used today for underwater acoustics and imaging. A most notable example in the second case is the linear theory of aeroelasticity that continues to dominate flutter analysis in the aeronautics industry. However, many fluid-structure interactions are nonlinear, and some are highly nonlinear. In the past, these have been dealt with using tests, or have been simply avoided or ignored. Today, the situation has begun to change, as highly nonlinear fluid-structure interactions have become of the utmost importance for the design of future aircraft, advanced spacecraft, and next-generation underwater systems. This is the case, for example, for the N+3 aircraft concept based on a strut-braced wing, NASA's new low density supersonic decelerators, and currently envisioned underwater vessels that feature a larger than ever number of implodable volumes. Furthermore, for many reasons ranging from safety to feasibility, there is currently a strong need to predict such highly nonlinear interactions numerically. Unfortunately, because of the aforementioned previous trends, the numerical simulation of highly nonlinear fluid-structure interaction problems is currently at a state where it is fraught with computational challenges. To this effect, this lecture will first overview this renaissance of fluid-structure interactions, then present a unified computational framework for their numerical prediction. It will highlight the recent impact of this framework on the design of micro air vehicles with flexible flapping wings, the prediction of the vertical tail buffeting of fighter jets at high angles of attack, the understanding of parachute inflation dynamics, the aeroelastic tailoring of Formula 1 cars, and the failure analysis of submerged implodable volumes.

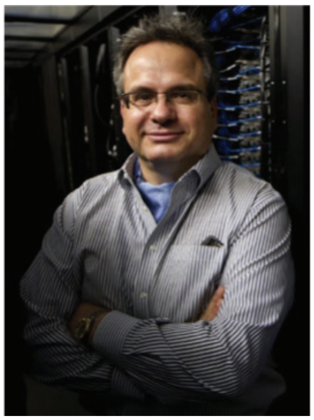
WILLIAM E. BOEING
DEPARTMENT OF AERONAUTICS & ASTRONAUTICS
UNIVERSITY *of* WASHINGTON

Monday, October 10, 2016 @ 4:00pm
Johnson 075, UW Seattle

Visitor RSVP: contact@aa.washington.edu

THE WILLIAM E. BOEING DEPARTMENT OF
AERONAUTICS & ASTRONAUTICS

... Distinguished Guest Speaker ...



DR. CHARBEL FARHAT
STANFORD UNIVERSITY

Department of Aeronautics and Astronautics
Department of Mechanical Engineering
Institute for Computational and Mathematical Engineering

Charbel Farhat is the Vivian Church Hoff Professor of Aircraft Structures, Chairman of the Department of Aeronautics and Astronautics, Director of the Army High Performance Computing Research Center, and Director of the King Abdullah City of Science and Technology Center of Excellence for Aeronautics and Astronautics at Stanford University. He is a designated ISI Highly Cited Author in Engineering, a member of the National Academy of Engineering, a member of the Royal Academy of Engineering, a member of the US Air Force Scientific Advisory Board, and a Fellow of six professional societies: AIAA, ASME, IACM, SIAM, and USACM, and WIF. He was knighted by the Prime Minister of France in the Order of Academic Palms and awarded the Medal of Chevalier dans l'Ordre des Palmes Academiques. He is also the recipient of many other professional and academic distinctions including the Lifetime Achievement Award from ASME, the Structures, Structural Dynamics and Materials Award from AIAA, the John von Neumann Medal from USACM, the Gauss-Newton Medal from IACM, the Gordon Bell Prize and Sidney Fernbach Award from IEEE, and the Modeling and Simulation Award from DoD. He was selected by the US Navy recruiters as a Primary Key-Influencer and flew with the Blue Angels during Fleet Week 2014.on the design of micro air vehicles with flexible flapping wings, the prediction of the vertical tail buffeting of fighter jets at high angles of attack, the understanding of parachute inflation dynamics, the aeroelastic tailoring of Formula 1 cars, and the failure analysis of submerged implodable volumes.

WILLIAM E. BOEING
DEPARTMENT OF AERONAUTICS & ASTRONAUTICS
UNIVERSITY *of* WASHINGTON

Monday, October 10, 2016 @ 4:00pm
Johnson 075, UW Seattle

Visitor RSVP: contact@aa.washington.edu