Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

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*Institute of Mechanical Systems: Prof. G. Haller (NDS)*
*Institute of Fluid Dynamics: Prof. P. Jenny, Prof. T. Rösgen (IFD)*

19/06/2019

# I N V I T A T I O N

to a talk as part of the

# Colloquium Thermo- and Fluid Dynamics

**Date:** **Wednesday, September 18, 2019**

**Time:** **16:15h**

**Place:** Machine Laboratory ETH Zurich, **Lecture Hall ML H 44**

**Speaker:** **Prof. Dimitris Drikakis**
University of Nicosia, Cyprus

**Title:** **Acoustic effects in compressible flows**

Acoustic, or sonic, fatigue has been a constant aircraft maintenance issue since the advent of the turbojet engine. The issue has beset both civilian and military aircraft, and the “evolution” of high-performance military aircraft has only served to exacerbate the issue. Acoustic fatigue is characterized by resonant response in lightly damped, thin-gauge aircraft structure. The jet and/or boundary layer noise is stochastic and so the structural response is random and very often nonlinear. Therefore, a proper approach to this phenomenon requires understanding across multiple disciplines - nonlinear structural dynamics, aerodynamic/acoustic loading, high-cycle fatigue and associated experimental techniques. To further complicate the issue, high-performance, high-speed aircraft also require temperature as a necessary parameter for prediction.

The present talk concerns acoustic loading effects in high-speed transitional and turbulent boundary layers. Theoretical and numerical developments will be presented, including results from high-order implicit large eddy simulations in conjunction with the atmospheric (von Karman) multimode energy spectrum at Mach 4, 6 and 8 and for different inflow turbulence intensities. It is shown that different scaling laws govern the spectrum in the transition region. The Mach number has a direct impact on the spectrum for both transitional and fully turbulent flows, especially in the high-frequency region of the spectrum. Furthermore, several different models have been investigated; however, existing models fail to capture the correct behaviour of pressure fluctuations in supersonic and hypersonic boundary layers across a broad range of frequencies. Modification of the models by introducing compressibility corrections shows promising results.

*Host: Prof. G. Haller*

**Guests are welcome!**

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