APPLICATION OF TIME-FREQUENCY TOOLS IN AEROACOUSTICS: IDENTIFICATION OF NOISE SOURCES AND THEORETICAL MODELLING

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The need for quieter aircraft, especially during take-off, requires a great theoretical effort to identify and control aerodynamic noise. Despite many decades of research, the physical mechanisms underlying the generation of noise, especially for propulsive jets, are still vague and the techniques adopted to control the flow and abate noise are not yet established.

This lecture focuses on the application of time-frequency analysis (single and multi-variate wavelet transform) to clarify this puzzling problem. Recent theoretical and experimental results concerning the identification of noise sources in turbulent shear flows will be briefly reviewed. Due to their relevance in the community noise problem, attention will be focussed on high Reynolds number jets and significant results obtained through the application of wavelet analysis to aeroacoustic data, including cases with flow control, will be presented. Theoretical implications, in particular related to the role played by instability waves, will be also considered.

A brief review of results obtained in other situations, including incompressible turbulent boundary layers, tip leakage flows and propeller/rudder interactions, will be included in the lecture.