Controlling rapid oscillations in flow structure interactions

Irena Lasiecka
University of Memphis, Memphis
University of Virginia, Charlottesville
IBS, Polish Academy of Sciences, Warsaw
lasiecka@memphis.edu

Flow-structure interactions are ubiquitous in nature and in everyday life. Flow or fluid by interacting with structural elements can lead to oscillations, hence impacting stability or even safety.

In this lecture we shall describe mathematical models describing the phenomena, These are represented by a 3 D Euler Equation coupled to a **nonlinear** dynamic elasticity on a 2 D manifold. Strong boundary-type coupling at the interface between the two media is at the center of the analysis. This provides for a rich mathematical structure, opening the door to several unresolved problems in the area of nonlinear PDE's, dynamical systems, related harmonic analysis and differential geometry. One of the central aspects is a question of uniqueness and sensitivity of *weak* solutions [ie of finite energy]. To contend with the difficulty, new methods in nonlinear analysis based on compensated compactness and harmonic analysis have been developed [4, 3].

Part of this talk is based on recent work [1, 2] and also work completed while the author was a member of the MSRI program "Mathematical problem in fluid dynamics" at the University of California Berkeley during the Workshop on Mathematical Theory of Fluid Dynamics, Spring 2021, Summer 2023

References

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