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Control and Design of Structures and Fluids

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ABSTRACT

Control and design problems are ubiquitous in engineering applications, in particular for fluids and structures. In this lecture we shall describe how Applied Mathematics, combining the theory of Partial Differential Equations, Control and Numerical Analysis handles these issues in an efficient manner.

In particular we shall address the problem of control of flows in the presence of shocks, relevant in aeronautical engineering applications. In this context the lack of regularity of solutions makes the sensitivity analysis both complex and relevant.

We shall also consider the problem of the optimal placement of sensors, actuators and dampers for wave equations. We shall show that, depending on the complexity of the data to be observed/controlled, one may distinguish cases in which the optimal set is constituted by a finite number of subdomains, from others in which the optimal set is of Cantor type or those when relaxation occurs.
These results will be illustrated by numerical simulations.