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Séminaire LVA

Control of sound and vibration by means of piezoelectric networks and acoustic wave propagation in heterogeneous continua

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This presentation is divided in two main parts, the first one concerns the reduction of radiated and transmitted sound power by means of piezoelectric passive networks, the second focuses on the study of acoustic wave propagation in heterogeneous continua.

The two topics are strongly related. In fact both mathematical models involve coupled evolution equations which show strong parallels, and whose solution is found using the same techniques.

Concerning the sound of control two main control strategies are considered: localized and distributed passive piezoelectric control.

In localized control the piezoelectric elements are positioned in selected locations, and the circuit is optimized for concentrating the effort in the reduction of the radiated sound power. In distributed control the transducers are uniformly disposed on the structure, exploiting this spatial distribution for controlling the radiation. The modeling of an innovative structure, the Piezoelectric Resistive Electrode (PRE) plate, exploiting the strategy of distributed control is described.

As far as the study of wave propagation in heterogeneous continua is concerned, we analyze of the frequency-dependent behavior of compression waves crossing the boundary between two dissimilar fluid saturated porous media is mainly addressed. In order to take into account the micro-heterogeneities of the porous matrix, a second gradient theory is used to deduce the bulk equations and the naturally associated boundary conditions. As a first result, it is shown how the repartition of energy among the reflected and transmitted waves is strongly influenced by the introduced second gradient parameter. In particular, an interesting dependence on the frequency of both the reflection and transmission coefficients can be observed.