

Introduction

In **Active Structural Acoustic Control (ASAC)**, the noise produced by shell like structures is attenuated with structural actuators such as surface-bonded piezoelectric patches (see Figure 1). Furthermore sensors are used that measure structural vibration. If a disturbance acting on the structure, such as an incident sound field, is unknown and broad band in frequency, **feedback control** strategies can be applied to obtain sound reduction.

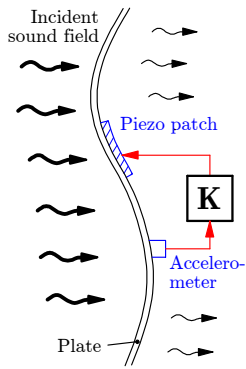


Figure 1: Transmission loss with feedback control.

Numerical Modelling

A numerical tool has been developed to evaluate the structural and acoustic response when feedback control is applied. The structure and piezoelectric patches are modelled with the **Finite Element Method (FEM)**. Model reduction techniques are applied to reduce the number of degrees of freedom. Hence the performance of several control strategies can be evaluated with small computational effort.

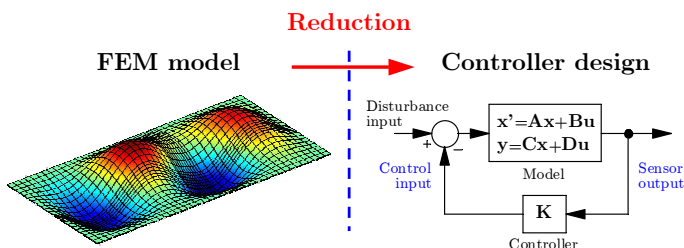


Figure 2: Numerical tool.

Experimental Validation

The experimental setup consists of a clamped rectangular aluminium plate with two piezoelectric patches (see Figure 3). One patch is used to excite the plate (*disturbance patch*). The second patch (*control patch*, actuator) is part of a control system in combination with an accelerometer (sensor). The controller is designed to **damp** the structural vibration, consequently leading to a reduction of radiated sound.

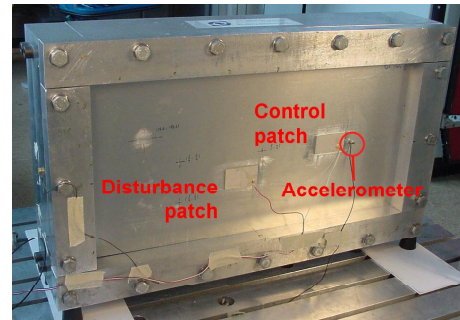


Figure 3: Experimental setup.

The acoustic response is monitored with a microphone placed in front of the plate. Figure 4 compares the predicted and measured pressure levels, without control (*passive*) and with control (*active*). The results show a significant reduction of the acoustic response near the resonance frequencies, and furthermore show a good correspondence between model and measurement.

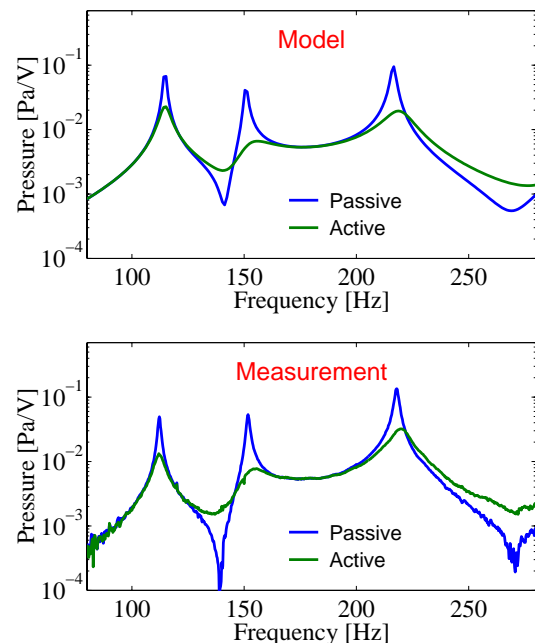


Figure 4: Predicted and measured acoustic response.

Conclusions

- Noise produced by shell like structures can be attenuated with structural vibration reduction.
- A numerical tool has been developed and validated for controller design in active structural acoustic control.