External Flow and Cabin Interior Noise Analysis of Hyundai Simple Model by Coupling CAA++ and ACTRAN

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ABSTRACT

The interior vehicle noise due to the exterior aerodynamic field is an important topic in the acoustic design of a car. The air flow detached from the A-pillar and impacting the side windows are of particular interest as they are located close to the driver / passenger and provides a lower insulation index than the trimmed car body parts. HMC is interested in the numerical prediction of this aerodynamic noise generated by the car windows with the final objective of improving the products design and reducing this noise.

The methodology proposed in this paper relies on two steps: the first step involves the computation of the exterior flow and turbulence induced non-linear acoustic field using the CAA(Computational aeroacoustics) solver CAA++. The second step consists in the computation of the vibro-acoustic transmission through the side window using the finite element vibro-acoustic solver Actran. The internal air cavity including trim component are included in the simulation. In order to validate the numerical process, an experimental set-up has been created based on a generic car shape. The car body includes the windshield and two side windows. The body is made of aluminum and trimmed with porous layers.

First, this paper describes the method including the CAA and the vibro-acoustic models, from the boundary conditions to the different components involved, like the windows, the trims and the car cavity is detailed. In a second step, the experimental set-up is described. In the last part, the vibration of the windshield and windows, the total wind noise level results and the relative contributions of the different windows are then presented and compared to measurements. The influence of the flow yaw angle (different wind orientation) is also assessed.