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JISFA3#4 - A multi-port scattering matrix formalism for the acoustic prediction in duct networks

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Duct acoustic network modelling is commonly carried out using the transfer matrix formalism which is limited to the low frequency range. The aim of this work is to extend it to higher frequencies by taking into account the multi-mode acoustic propagation. The first step is to compute, via finite element discretisation (FEM), the multi-port multi-modal scattering matrix of each element. The second step is to transform it into a scattering matrix for the acoustic power, relying on assumptions which are often used for the study of medium-to-high frequency broadband noise. The method is applied to typical elements such as expansion chamber mufflers and air conditioning veins. In all cases, the power-flow model is compared to the FEM solution in terms of Transmission Losses. It is concluded that this simplified model is a reliable tool for the analysis of complex networks encountered in HVAC duct networks.

Presenter(s) : CYRIL CALMETTES (Airbus Helicopters); EMMANUEL PERREY-DEBAIN (Université Technologique de Compiègne, Laboratoire Roberval (FRE UTC - CNRS 2012)); EMMANUEL LEFRANÇOIS (Université Technologique de Compiègne, Laboratoire Roberval (FRE UTC - CNRS 2012)); JULIEN CAILLET (Airbus Helicopters)

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