

Case Study

Energy Finite Element Analysis by MES used to Control Interior Aircraft Noise

Business Profile

Michigan Engineering Services, LLC (MES) is a research and development company, specializing in developing commercial software and advanced technology for engineering simulations. MES' activities span both the defense and the commercial industrial sectors. Through the engineering services component of MES, an efficient technology transition is facilitated to its customers.

Challenge

Aircraft companies have the need to control interior noise that gets generated due to sources such as motors, engine, air flow, etc. It is strongly desired to have the least amount of noise with the smallest possible penalties in cost and weight. Numerical methods can offer information for determining the type, quantity, and placement of acoustic, mass, and damping treatments. Using conventional Finite Element Analysis (FEA) for simulations up to 8KHz (typical upper frequency of interest) is either computationally expensive or infeasible, due to the small size of finite elements which are required to model the aircraft at such high frequencies.

Solution - EFEA

The Energy Finite Element Analysis (EFEA) requires a small number of elements in the model because the new primary variables are based on the energy of the structural vibration and of the acoustic field. The EFEA uses a library of elements (similar to the FEA) for modeling any physical system and a library of joints (similar to the coupling loss factors in Statistical Energy Analysis) for representing the power transfer mechanisms which exist in the system.

Benefits

The EFEA model can be developed using the same tools (i.e. Altair HyperMesh™) and by following a process similar to developing FEA models. Due to the significantly fewer elements required compared to FEA, alternative designs can be evaluated rapidly enough in order to influence the design.

Results

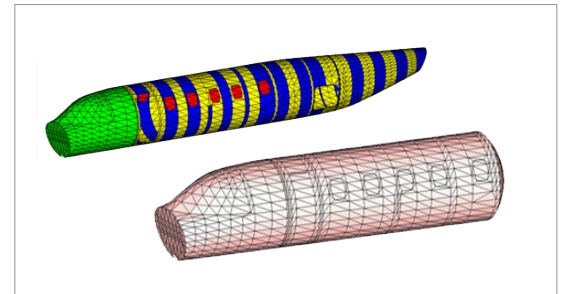
Simulation results have been compared successfully to test data multiple times for aircraft structures. Composite or metal structures can be analyzed. The placement and the selection of the treatment can be optimized for minimum weight.

MES

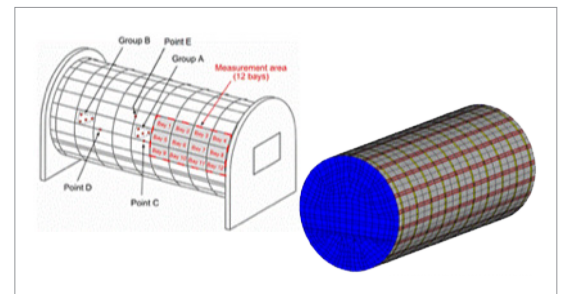
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Controlling Aircraft Interior Noise



Structural and Acoustic EFEA model



Test Fixture and EFEA Model for Composite Fuselage

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