#ArchitectingAviation

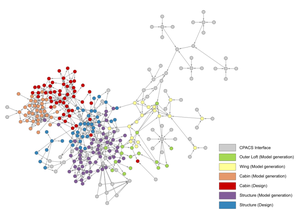
# FUSELAGE GEOMETRY ASSEMBLER: Knowledge-Based Engineering Framework for Multi-Model Generation

Improve model consistency in collaborative multi-disciplinary design optimization - Automated finite element model setup for the prediction of interior noise from overall aircraft design data

## Multi-model generation via KBE methodology

Using a knowledge-based engineering (KBE) methodology, the setup of multi-fidelity models for the evaluation of the aircraft cabin is carried out in FUGA. For the prediction of interior noise, vibro-acoustic models of the fuselage structure, cabin lining and interior cavities need to be generated. This model setup is automated in FUGA, which is achieved via:

- Graph-based KBE modelling engine in python with native support for lazy evaluation, caching and invalidation



- Fully CPACS-compatible automated geometry generation of fuselage structures
- Use-case independent geometry creation with Open Cascade Technologies CAD library
- Geometry-based, automated meshing routines utilizing Gmsh meshing library
- Automatic creation of fluid-structure interfaces
- Solver-agnostic model formulation with support for a variety of solvers

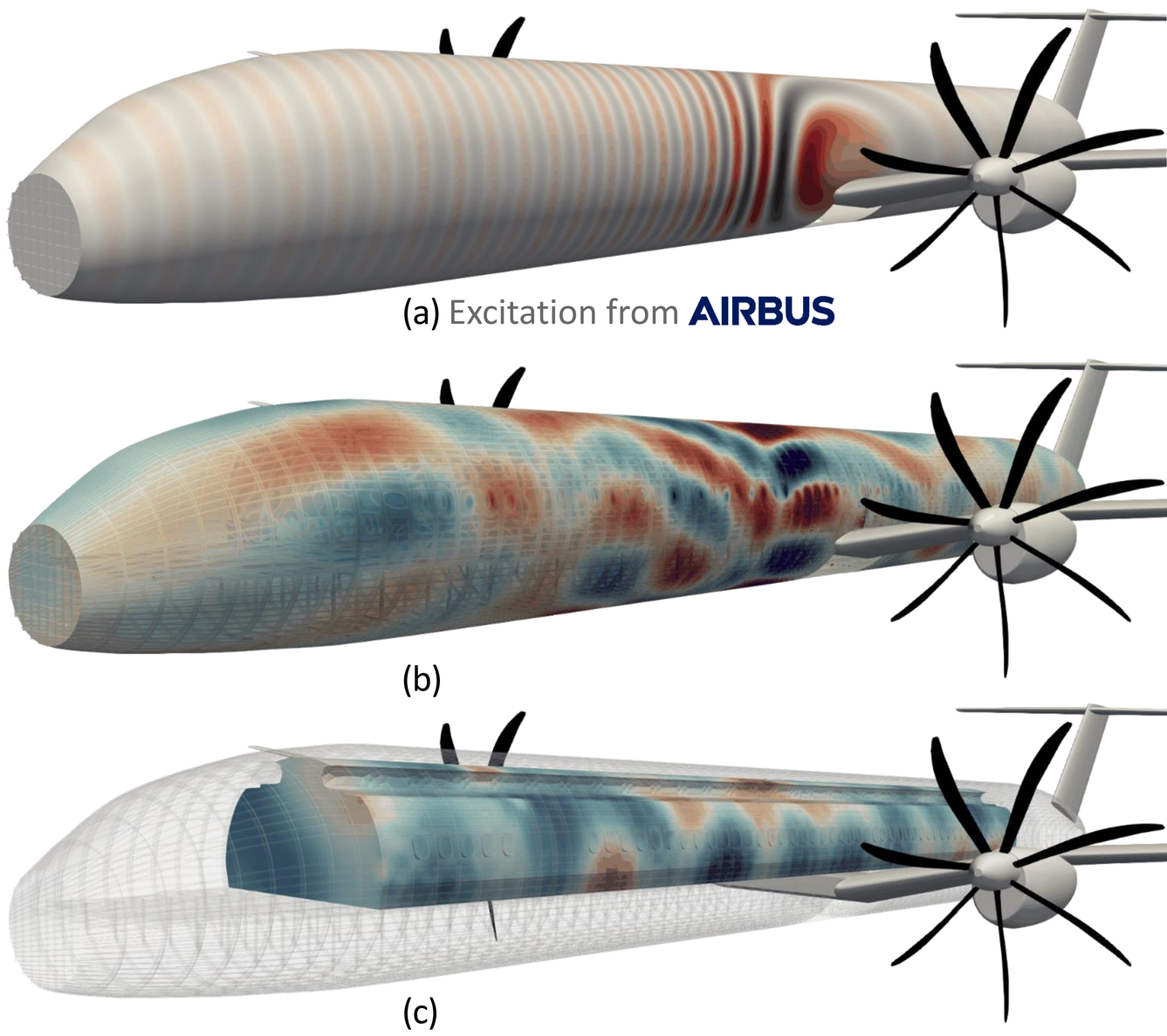



Fig. 2: Simulation results from propeller excitation (a) at blade passing frequency for the structural vibrations (b) and resulting passenger cabin pressure distribution (c) of D250 turboprop aircraft

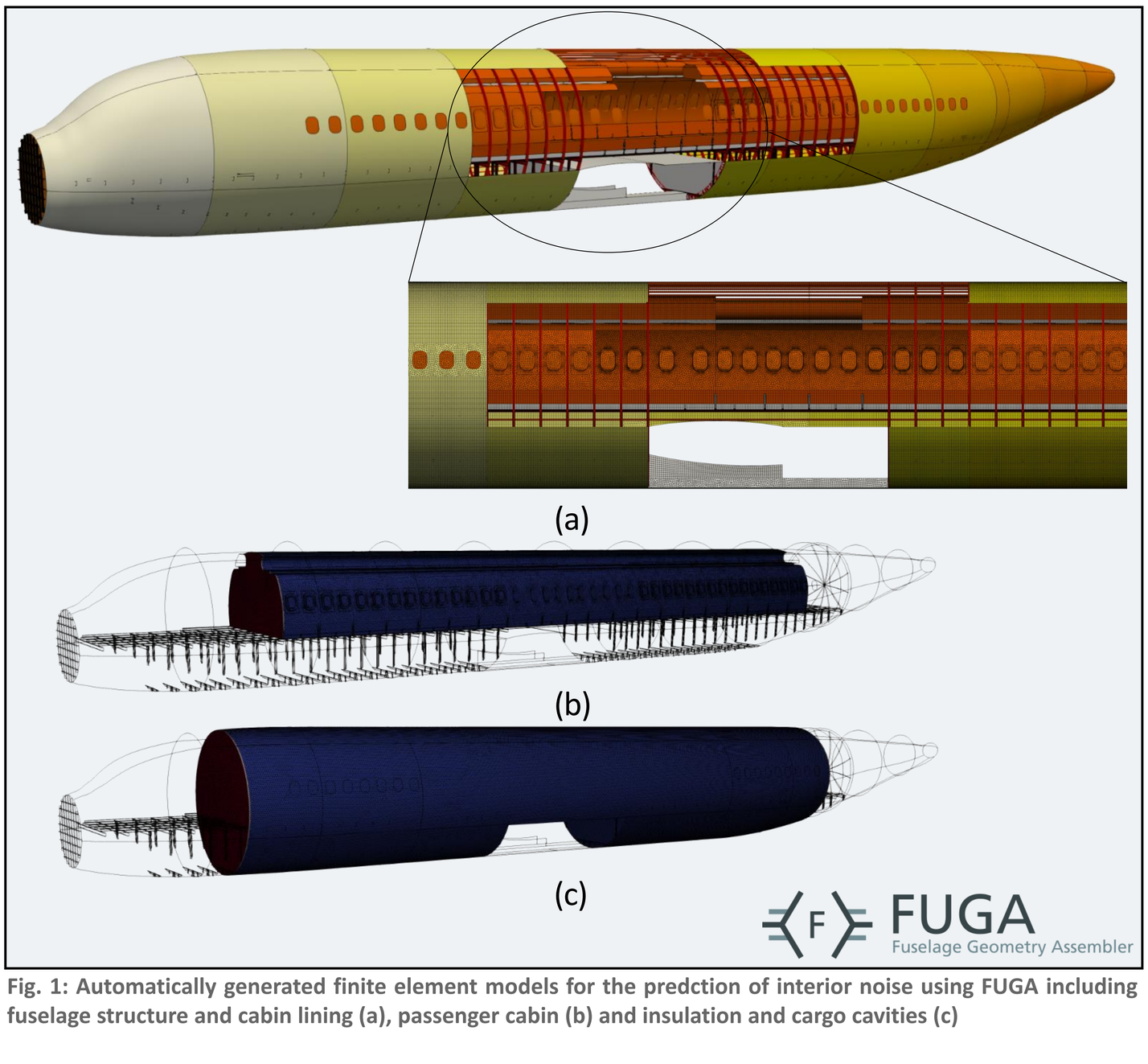



Fig. 1: Automatically generated finite element models for the predction of interior noise using FUGA including fuselage structure and cabin lining (a), passenger cabin (b) and insulation and cargo cavities (c)

## Facilitate aircraft evaluation in early design phase

High interior noise levels counteract the passenger and customer acceptance of new aircraft designs. The evaluation of cabin noise in early design stages supports design trades regarding the design of the propeller and engine components. It can also be used for the evaluation of necessary noise control measures.

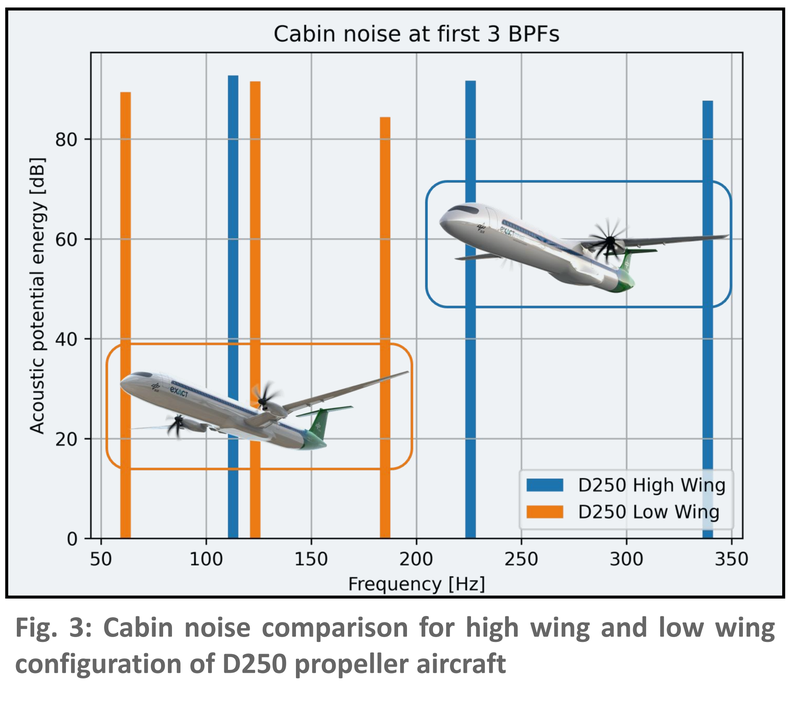



Fig. 3: Cabin noise comparison for high wing and low wing configuration of D250 propeller aircraft

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**Related publication:**
Hesse et al. (2024) - Knowledge-based model generation for aircraft cabin noise prediction from pre-design data.