

Conceptual design and optimisation of silencers

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Well designed silencers not only need to perform acoustically, but also need to be efficient in terms of aerodynamic flow losses, use of materials, space and weight. The design of reactive mufflers has historically relied on analytical 1D codes, which can quickly provide assessment of the performance of simple components and layouts, but result in rather crude designs.

Access to 3D numerical tools, such as FFT-Actran, has improved prediction capabilities for complex geometries, but models are generally expensive to set up and run and so are more suitable for the detailed design phase, where the full design space cannot be explored any more.

In this study we investigate the potential of using Actran in conceptual design in order to develop an efficient and accurate silencer design tool. By taking advantage of Python scripting and optimisation embedded in Actran, schematic muffler components can be quickly assembled and optimised to achieve specific sound quality performance. The resulting CAD models can also be used to analyse details of the flow and potential sources of aerodynamic noise.

Besides resulting in better designs overall, these optimisation methods have the potential to improve the efficiency of both the first conceptual design phase and also the detailed work by reducing the number of final models to test both numerically and experimentally.

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