Abstract

We plan to develop intelligent design assistants that support the engineer by generating design proposals for predefined, desired acoustic properties. A consideration of acoustics from the very beginning design stages is forced, in which the design can still be significantly influenced. Reasoned by negative environmental impacts of high noise levels (health, discomfort), great efforts are made to reduce sound pressure levels in product and vehicle design. Unfortunately, acoustic problem often arise in late design stages, which often leads to expensive noise abatement measures. A deep consideration of acoustics in early phases is expected to unlock a great potential for low noise designs. We propose a data-driven neural network-based approach. First, we train a forward model to predict sound pressure levels obtained using finite element models of selected academic examples. Different forms of specifying this training and the model's architecture are compared. Second, we generate design proposals through two different data-driven approaches, which are novel to this field: Directly optimising in design space using backpropagation and generative adversarial networks (GANs). The former conducts optimisation based on analytical gradients, which are favourably accessible through neural networks. The GAN-based approach follows its successful application in image generation and shall deliver one-shot design proposals without any iteration. Both methods will leverage insights gained from studying the forward model. Finally, we employ our system in a challenging aircraft fuselage problem to demonstrate the applicability in real-world problems.