Karlsruhe Institute of Technology

BME Department of Fluid Mechanics

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Master's Project

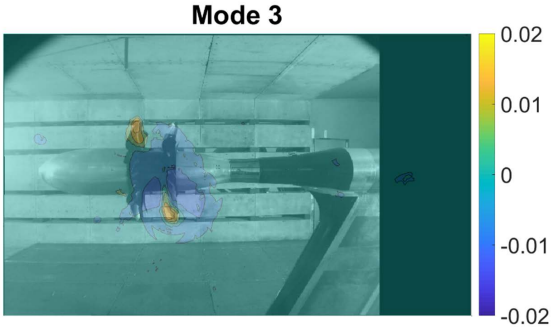
# Investigating Shaft Order Noise Sources of Counter-Rotating Open Rotors using Proper Orthogonal Decomposition and Beamforming Technology

## Background

With the ever-increasing role of air transportation in our everyday lives, improvements in customer satisfaction and comfort are becoming increasingly important. These demands, as well as increasingly stringent noise regulations, noise reduction is a focal point in today's research related to aircraft engines and turbomachinery applications. An effective method of noise source localization is phased array microphone measurements and beamforming technology. The results are often presented visually in the form of beamforming maps, which show the dominant noise sources of a given frequency bin. While the application of this technique can provide researchers with useful information regarding the noise generation of the investigated source, there are some limitations and hardships associated with the method. One of the hardships is finding repeating patterns in the results of the numerous frequency bins under investigation.

## Content of the Thesis

In this Master's Thesis Project, the implementation of a combined beamforming and Proper Orthogonal Decomposition (POD) method will be investigated for turbomachinery noise source localization and identification. The POD method has been successfully applied in numerous scientific disciplines, including pattern recognition of various physical phenomena, such as the analysis of complicated velocity fields. The POD algorithm therefore provides an orthogonal basis for representing a given data set, and finding an optimal, lower dimensional approximation for it. Hence, it can be used to reduce the degrees of freedom of a complex system, and accomplish the reconstruction of the data set without losing significant describing features and components of the inspected phenomena.




Through the combined application of beamforming and the POD method, the Master's Thesis Project examines the turbomachinery noise sources of a Counter-Rotating Open Rotor (CROR) aircraft engine, which could perspectively become the type of engine used on certain types of regional aircraft configurations, once their noise levels are reduced.

The project will be conducted at BME and supervised by both universities.

**Beneficial Skills**

aero acoustics, fluid mechanics, signal processing, MATLAB

**Start:** at any time

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