

## Acoustic Signal Separation and Noise Reduction of a Contra-Rotating Fan

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**Abstract:** How to reduce fan noise has always been a significant research topic in equipment ranging from small-scale devices, such as computer cooling fans and building ventilation fans, to large high bypass ratio turbo engines. In recent years, in order to produce higher pressure rise or larger flow rate with lower noise level in the fan stage, interest in the contra-rotating fan (CRF) configuration has been rekindled. The Vold-Kalman order tracking filter technique was employed to separate tonal and broadband noise components from CRF acoustic data to study the characteristics of the noise spectrum. Based on the spectrum peaks, noise reduction solution with casing treatment is proposed according to acoustic performance prediction by finite element simulation. In the simulation, the CRF is modelled at one end of a duct, which is surrounded by a semi-spherical space with perfect match layer to simulate the free field condition. The other end of the duct is modelled with non-reflecting boundary condition to simulate the anechoic termination. The simulated and experimental results show that casing treatment by micro-perforated panels can significantly reduce the CRF noise.