Identifiant de la contribution : **255** Type : **non spécifié**

”SIGPRO#6 - Extraction of the acoustic modal content of a turbofan engine in non stationary conditions using order analysis”

mardi 11 juillet 2023 12:20 (20)

The analysis of acoustic fields in turbofan engines is a challenging task, due to the geometrical complexity of the ducts, of the multiple noise generation mechanisms and the poor signal-to-noise ratio (SNR) related to the strong flow noise. Modal analysis can be carried out using different kinds of microphone arrays. It is proposed in this work to conduct the analysis on non-stationary data using order extraction based on angular resampling of signals. A modal analysis of tonal fan noise is applied to deceleration measurements collected during the European project TurboNoiseBB at the Anecom test facility. Orders are extracted from time domain microphone signals so as to extract the instantaneous envelope and phase. The instantaneous modal content is then extracted using modal identification. The azimuthal mode content of the three first Blade Passing Frequencies (BPF) is obtained through an iterative Bayesian inverse approach. Particularly the modal spectrum for the second BPF shows an interesting pattern with peaks and troughs throughout the deceleration. It suggests that detected modes are influenced by the azimuthal distribution of probes. Results are compared to steady state measurements at different operating points obtained from the same test rig.

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Classification par session : Survishno 3 / Signal Processing