

ACOUSTICS2008/307
Contra-rotating fans noise prediction for jet engine performance optimization

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This work fits within the framework of the European research project VITAL, which is dedicated to the development of technologies aimed at reducing the environmental impact of jet engines. In this respect, a new concept of ducted contra-rotating fans is investigated. The present contribution to this project is to elaborate a noise prediction tool for performances optimization. On the basis of the helicoidal surface theory, Hanson previously developed a harmonic formulation for the propfan rotor/rotor interaction. This method is here extended in order to take into account the duct effects and the noise radiated by the rear struts. A computer program has been written to predict the pressure distribution in the near field and to estimate the noise spectra in the far field. The results are validated with computational fluid dynamics simulations and compared with available public data. Those predictions are then included in a global noise computation with the other engine acoustic sources (coaxial jet, combustor and so on), and a multidisciplinary optimizer is used for the engine noise minimization.