PERFORMANCE MODEL OF A VERY HIGH BYPASS RATIO COUNTER ROTATING TURBO FAN ENGINE

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ABSTRACT

Nowadays Snecma focuses on new engine architectures in order to meet the future demands in civil aviation. One of these considered concepts is aircrafts powered by counter rotating fan engines which aim at tackling both noise and polluting emissions. A powerful way to reduce the perceived noise is to reduce the fan rotating speeds, which requires to lower fan pressure ratio. This thesis continues a study on an innovative counter rotating fan architecture carried out by Snecma from 2005 to 2010 for VITAL (European Commission funded project). It is a way to meet the noise target while maintaining acceptable engine dimensions and matching installation constraints since each fan has a smaller diameter than the current ones, and an individual low pressure ratio. Therefore the drag is decreased and less fuel is burnt.

In order to fulfill these ambitious objectives, the first step of this thesis is to use the code of the VITAL model developed with Janus (Snecma in-house code) in order to create a new code for the PROOSIS software. When modeling two counter rotating fans, the key point is to take into account the influence from the first stage on the second one. Since the aft fan “sees” a perturbed flow by the inlet fan wake, its characteristic map is not the usual one anymore. One major challenge was the new design of a two separated flow and three-spool counter rotating engine driven by a gearbox which meets the very high bypass ratio target. The model finally turned out to be operational for a relevant set of initialization parameters and thus makes now possible more accurate studies on counter rotating turbofan engines in the R&T unit.
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