The 10th TSME International Conference on Mechanical Engineering
10th – 13rd December 2019
Pattaya, Thailand

Acoustic Power Prediction of High BPR Turbofan Engine with Chevron Nozzle during Take-off and Landing

Rapee Ujjin[1,*], Choosak Ngaongam[1], Chatmongkol Phoomee[1] and Jirantanin Kanabkaew[1]

[1]Department of Aviation Maintenance Engineering, College of Engineering, Rangsit University, Pathumthani 12000, Thailand

[*]Corresponding Author: Rapee.u@rsu.ac.th

Abstract. Aircraft noise is the major cause of noise pollution around the vicinity of an airport. The major contributor to the overall sound levels is jet noise from engines. Adding chevron pattern at the fan nozzle is one of the noise reduction enhancements found in current turbofan engine design features. This paper aims to study the power level of sound created in jet shear from the combination of ambient stream, fan and exhaust gas. Computational fluid dynamic modelling of a high bypass turbofan engine with a round shape and chevron nozzle were carried out during take-off and landing conditions. It was found that during take-off, the acoustic power level of the engine without a chevron nozzle was 105.95 dB, while the chevron nozzle was capable of reducing the sound level to 43.57 dB. During landing, the sound level of the round shape and chevron nozzle model were 145.77 dB and 47.51 dB respectively. The turbulent intensity area at the fan cowling nozzle, where the ambient air stream and bypassed air from the fan mixed together, produced the highest sound power level. Therefore, slower aircraft speed during approach produced a higher noise level than during take-off due to higher turbulent intensity and larger jet shear area around the high bypass fan cowling nozzle. The chevron pattern nozzle was capable of reducing turbulent intensity, which in turn reduced the acoustic power level.

Keywords: Acoustic power level, Turbofan, CFD, Aircraft noise, High bypass ratio