

Effects of Inlet Distorted Flows on the Performance of an Axial Compressor

Authors : Asad Islam, Khalid Parvez

Abstract : Compressor fans in modern aircraft engines are of considerable importance, as they provide majority of thrust required by the aircraft. Their challenging environment is frequently subjected to non-uniform inflow conditions. These conditions could be either due to the flight operating requirements such as take-off and landing, wake interference from aircraft fuselage or cross-flow wind conditions. So, in highly maneuverable flights regimes of fighter aircrafts affects the overall performance of an engine. Since the flow in compressor of an aircraft application is highly sensitive because of adverse pressure gradient due to different flow orientations of the aircraft. Therefore, it is prone to unstable operations. This paper presents the study that focuses on axial compressor response to inlet flow orientations for the range of angles as 0 to 15 degrees. For this purpose, NASA Rotor-37 was taken and CFD mesh was developed. The compressor characteristics map was generated for the design conditions of pressure ratio of 2.106 with the rotor operating at rotational velocity of 17188.7 rpm using CFD simulating environment of ANSYS-CFX®. The grid study was done to see the effects of mesh upon computational solution. Then, the mesh giving the best results, (when validated with the available experimental NASA's results); was used for further distortion analysis. The flow in the inlet nozzle was given angle orientations ranging from 0 to 15 degrees. The CFD results are analyzed and discussed with respect to stall margin and flow separations due to induced distortions.

Keywords : axial compressor, distortions, angle, CFD, ANSYS-CFX®, bladegen®

Conference Title : ICMIME 2016 : International Conference on Mechanical, Industrial, and Manufacturing Engineering

Conference Location : Paris, France

Conference Dates : March 14-15, 2016