World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:10, No:08, 2016

Control of a Plane Jet Spread by Tabs at the Nozzle Exit

Authors : Makito Sakai, Takahiro Kiwata, Takumi Awa, Hiroshi Teramoto, Takaaki Kono, Kuniaki Toyoda

Abstract : Using experimental and numerical results, this paper describes the effects of tabs on the flow characteristics of a plane jet at comparatively low Reynolds numbers while focusing on the velocity field and the vortical structure. The flow visualization and velocity measurements were respectively carried out using laser Doppler velocimetry (LDV) and particle image velocimetry (PIV). In addition, three-dimensional (3D) plane jet numerical simulations were performed using ANSYS Fluent, a commercially available computational fluid dynamics (CFD) software application. We found that the spreads of jets perturbed by large delta tabs and round tabs were larger than those produced by the other tabs tested. Additionally, it was determined that a plane jet with square tabs had the smallest jet spread downstream, and the jet's centerline velocity was larger than those of jets perturbed by the other tabs tested. It was also observed that the spanwise vortical structure of a plane jet with tabs disappeared completely. Good agreement was found between the experimental and numerical simulation velocity profiles in the area near the nozzle exit when the laminar flow model was used. However, we also found that large eddy simulation (LES) is better at predicting the developing flow field of a plane jet than the laminar and the standard k-ε turbulent models.

Keywords : plane jet, flow control, tab, flow measurement, numerical simulation
Conference Title : ICVA 2016 : International Conference on Vehicle Aerodynamics
Conference Location : Bangkok, Thailand
Conference Dates : August 30-31, 2016