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Heat Transfer Performance of a Synthetic Jet Generated by Diffuser-Shaped Orifice

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ABSTRACT

Synthetic jet impingement cooling has been identified to be an advanced cooling technique in a variety of applications such as turbine blade cooling, paper drying, and electronic cooling. The high heat removal capabilities with a simple construction of the device, demonstrate the advantage of synthetic jet compared to other methods. In the present work, the 3D numerical simulation using computational fluid dynamics (CFD) is carried out to predict the heat transfer performance of synthetic jet produced by speaker actuator with the diffuser-shape orifice. Numerical predictions are made for an orifice diameter of 6 mm with several opening angles. The excitation frequency of the speaker diaphragm is fixed at 100 Hz. Three vibration amplitude are used to investigate the effect of the different velocity of synthetic jet. The results showed that the opening angle of 90° is better than 45° and the heat transfer enhancement using a diffuser shaped orifice is more significant at a higher vibration amplitude. Also, the increment of vibration amplitude more than 0.6mm may not increase the cooling performance of synthetic jet.

Keywords:
Synthetic jet, diffuser-shape orifice, heat transfer, speaker actuator.