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Spanwise plumes in wakes behind heated cylinder AJITH KUMAR S, Indian Institute of Technology Madras, Chennai, ANIL LAL S, College of Engineering Trivandrum, SAMEEN A, Indian Institute of Technology Madras, Chennai
— 3D wake transition in flow past cylinder is interesting theoretically and industrially. A three dimensional Finite volume computation has been performed on an incompressible flow past heated cylinder to understand the wake behavior behind the cylinder, under the Boussinesq assumption. We study the heat transfer characteristics and the coherent structures behind the cylinder at different Prandtl numbers. In forced convection, the 3D transition occurs above Reynolds number, Re=180-190 (Re is based on the cylinder diameter). However, the present 3D computational analyses show that in mixed convection, the so called "mode-E" instability (3D transition of wake behind the cylinder caused by the heating of the cylinder) happens at a much lower Reynolds number. The co-existence of mushroom like coherent structures called the plumes along with the shed vortices is observed for a range of heating conditions. These plumes originates from the core of the upper vortex rows at a definite span wise wavelengths. The dependence of Prandtl number on the span wise wavenumber of these plumes is also analyzed.

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