Abstract

A numerical investigation was carried out to investigate the inherent physics associated with the flow of turbulent jet with adjacent solid boundary. Due to inclined orientation of the wall, the flow geometry of the domain is complex in nature. Consequently, the governing equations are transformed before they are discretized. The thesis begins with a brief introduction on different types of jet followed by a literature survey pertinent to the present work. The subsequent chapters presents the results of numerical simulation of the flow field of wall jet and offset jet flow with single and multiple inclined wall. Mean flow is presented qualitatively in terms of vector and streamline plot. The development of jet is shown by profiles of streamwise velocity and velocity component aligned with the wall along the flow direction and also by distribution of streamwise and cross stream components of velocity over the domain. Variation of crosswise locations of maximum velocity and jet half-witdh represented the growth of jet shear layers. The computed results showed that the growth of the outer layer and the jet spread vary linearly as the jet develops. The pressure field is depicted by streamwise development pressure profiles and the pressure contours. The evolution of the streamwise momentum flux is presented in terms of spanwise integral of mean momentum, pressure and turbulence fluctuations for all streamwise locations. The decay of integrated momentum flux is much slower as compared to the integrated energy flux in developed region of the oblique jets. Turbulent characteristics is presented by distribution of Reynolds stresses, turbulent kinetic energy, and rate of dissipation over the domain and also by variation turbulence stresses along the jet centreline. Development of turbulent field is presented by the streamwise evolution of the Reynolds stresses. Self-similar behaviour of mean and turbulent parameters are also investigated and presented in the form of similarity profiles of normalized Reynolds stresses and the mean velocity. Entrainment of surrounding fluids into the jet is also studied for plane parallel jets and wall jet flow on multiple inclined wall. The lift characteristics of the wall jet flow on multiple flat surface was computed and compared with available experimental and theoretical data. The normalized kinetic energy profiles at different streamwise locations highlight the difference between the turbulence field of an oblique wall jet and a reattached oblique offset jet. Near wall distribution of velocity is presented in inner coordinates which shows that a wall jet or a reattached offset jet on an incined wall has a universal inner region; however, the near wall profiles depicts significant deviation from *law of the wall* for smooth pipe flow or turbulent boundary layers. Defect law distribution of oblique offset jet data depicts relatively higher position when compared with channel flow or turbulent boundary layer.