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Swirling Strength Vortex Study in Confined Rectangular Jet BO KONG, MICHAEL OLSEN, RODNEY FOX, JAMES HILL, Iowa State University — Vortex behavior in confined rectangular jet (Re = 20K, Re = 50K) were examined by using vortex swirling strength as a defining characteristic. Instantaneous velocity fields were collected for by using Particle Image Velocimetry(PIV). Swirling strength fields were calculated from velocity fields, and then filtered with a universal threshold of 1.5 times of swirling strength RMS value. By identifying clusters in filtered swirling strength fields, vortex structures were defined. Both instantaneous swirling strength field data and vortex population calculation indicate that the positively (counterclockwise) rotating vortices are dominant on the left side of the jet, and negatively (clockwise) rotating vortices are dominant on the right side. As flow develops further downstream, vortex population decreases and the flow approach channel flow. At the locations of the left peak of turbulent kinetic energy, two point spatial cross-correlation of swirling strength with velocity fluctuation were calculated. Linear stochastic estimation was also used to interpret the spatial correlation results and to determine conditional flow structures. High speed PIV data were also analyzed by using swirling strength technique to trace development of vortices. Vortex trajectories were found by tracing individual swirling strength clusters. The speed and strength of individual vortex were also studied by using this method.

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