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Study of the near field wake of trips generating an artificially thick turbulent boundary layers EDUARDO RODRIGUEZ LOPEZ, PAUL J.K. BRUCE, OLIVER R.H. BUXTON, Imperial College London — The properties of an artificially thick turbulent boundary layer are influenced by its formation mechanism. Previous work has shown that wake or wall-driven mechanisms dominate boundary layer development depending on the trips aspect ratio. The current study characterizes these two formation mechanisms through the use of high-speed PIV in the near wake of obstacles arrays on a flat plate in a wind tunnel. The time resolved velocity field is studied using Optimal Mode Decomposition (OMD) generating a low order model which captures the representative motions. Results corroborate the original hypothesis and show that these mechanisms are divided in two families: (i) High aspect ratio trips (cylinders) generate vortices with a wall-normal axis which do not transfer information between the wall and the wake of the obstacle. In this case, the boundary layer growth is wall-driven entraining the low-momentum highly turbulent flow above it. (ii) Low aspect ratio trips generate spanwise vorticity increasing the influence of the obstacles wake in the wall region (wake-driven mechanism). A high level of correlation with the velocity fluctuations at the wall is maintained in case (ii) for the whole wake while in case (i) the correlation vanishes for heights smaller than half obstacle.

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