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Use of POD to Investigate Large-Scale Structures in Turbulent Flow with Rib-Roughness MAZIAR E. SAMANI, DONALD BERGSTROM, Department of Mechanical Engineering - University of Saskatchewan — In this work, Large Eddy Simulation (LES) of turbulent Couette flow is used to study the flow structures associated with the hydrodynamic roughness created by a series of ribs of square cross-section mounted perpendicular to the flow. Due to their geometric simplicity, ribs have been previously used to simulate turbulent flow over a rough surface. Both direct numerical simulation (DNS) (Orlandi et al., 2006) and experimental methods (Krogstad et al., 2005) have been used to study this type of roughness in the context of pressure driven flow in a channel. In this study, LES is used to simulate turbulent Couette flow with rib roughness on one wall. Proper Orthogonal Decomposition (POD) is applied to determine the large-scale flow structures in the wake region of the roughness elements. The spanwise vorticity and both streamwise and wall-normal velocity components are used as the computational variables for the POD. Comparisons are made to a similar POD analysis of the wake structure of an infinite square cylinder mounted in a uniform flow. Of specific interest is the interaction of the rib wakes with the turbulent boundary layer above.

Donald Bergstrom
Department of Mechanical Engineering - University of Saskatchewan

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