

Abstract Submitted  
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**Effects of freestream turbulence on the characteristics of separation and re-attachment in flow past obstacles.**<sup>1</sup> JACQUES VAN DER KINDERE, ROBERT HEARST, BHARATHRAM GANAPATHISUBRAMANI, University of Southampton — We study the characteristics of separation and reattachment in the presence of freestream turbulence (FST) on flows on ribs. This two-dimensional obstacle represents a canonical geometry in industrial aerodynamics. It consists of a forward-facing step, FFS, followed by a backward-facing step, BFS. An experiment at Reynolds number 20000 based on rib height,  $H$ , was carried out. The rib was fully submerged in a boundary layer and the freestream was subjected to varying turbulence intensities: 0.5, 3.5, 7.5 and 9.0%. Three rib lengths of  $L/H=1, 4$  and 8 were tested. Particle Image Velocimetry measurements show that increasing freestream turbulence consistently decreases recirculation lengths both on top and in the wake of ribs. The shrinkage of recirculation bubbles is also dependent on rib length because of the interaction between FFS and BFS. Snapshot Proper Orthogonal Decomposition suggests that FST modifies the dominant motions in the flow. The shape and ranking of POD modes of velocity above short ribs ( $L/H=1$ ) seems unaffected by FST until the 4th mode. In contrast, the longer ribs ( $L/H=4$  and 8) produce different dominant modes for each FST intensity. This signifies the dominant motions in the flow are affected by FST which could explain the different recirculation characteristics.

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