Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Experimental Investigation on Near-wall Turbulent Flow Structures over Deformable Roughness[1] MOSTAFA TOLOUI, NOLAN JOHN, JIARONG HONG , University of Minnesota — Wall-bounded turbulent flows over rough surfaces have been studied for almost a century. However, in most of the prior studies, little attention has been paid to the role of roughness mechanical properties, e.g. deformability, in altering the flow characteristics including both general turbulent statistics and near-wall flow structures. In this study, high resolution time-resolved digital in-line holographic PIV is employed to investigate the near-wall turbulent structures as well as turbulent statistics around and above deforming roughness structures. The rough wall samples consisting of tapered cylinders of size 0.5 mm in diameter and 3 mm in height are manufactured from transparent PDMS with similar geometrical features but various deformability levels. The experiments are conducted within an optically index-matched facility (using NaI solution) operating with different Reynolds numbers where roughness samples of different deformability are placed downstream of a 1.2 m long acrylic channel of 50 mm square cross section. The follow-up research envisions a large dataset including various Reynolds numbers and deformability to elucidate the role of roughness deformability on near-wall coherent structures and turbulent energy transport within and above the roughness sublayer.

[1]This work is supported by the startup package of Jiarong Hong and the MnDrive Fellowship of Mostafa Toloui from University of Minnesota

Jiarong Hong
University of Minnesota

Date submitted: 01 Aug 2015 Electronic form version 1.4