High-Order Velocity and Pressure Statistics from Direct Numerical Simulations of a Zero-Pressure-Gradient Turbulent Boundary Layer[1]
BRYAN KAISER, SVETLANA POROSEVA, University of New Mexico — High-order turbulence statistics in a zero-pressure-gradient turbulent boundary layer are important for developing turbulence models. They also provide an insight into the physics of turbulent flows. A complete database of one-point statistics extracted from the dataset of direct numerical simulations (DNS) of a zero-pressure-gradient turbulent boundary layer by the Universidad Politecnica de Madrid Fluid Dynamics Group was collected. Third-, fourth-, and fifth-order velocity central moments and second-order pressure-velocity correlations at two Reynolds numbers of 4101 and 5200 based on the momentum thickness will be presented. DNS data are in a good agreement with experimental data. Results of the validation of Millionshtchikov's hypothesis of quasi-normality and the Gram-Charlier series expansions for representing higher-order velocity moments in terms of lower-order moments will be reported. The two approaches are used as closing procedures in third- and fourth-order statistical closures, respectively.

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