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Random roughness effects on the near-wall flow in the transitionally rough regime[1] RONG MA, KARIM ALAME, KRISHNAN MAHESH, University of Minnesota — Direct numerical simulation of turbulent channel flow over a random rough wall is performed at $Re_\tau = 400$ and 600. The rough surface corresponds to the experiments of Flack and Schultz (personal communication). The skin friction coefficient of the random-rough channel matches with the experimental results of Flack and Schultz. The roughness effects on the near-wall regions of mean velocity, Reynolds stresses, pressure fluctuations and streamwise mean momentum balance are investigated. The statistics of wall-shear stress fluctuations in the peak (above the mean height location) and valley (below the mean height location) regions are examined. The probability distribution function of wall-shear stress shows a better collapse after subtracting the mean and normalizing by the root-mean-squared value. The distribution tail is widened by the random roughness, implying that the probability of extreme events is increased. The probability of extreme events in the random-rough channel increases with increasing Re_τ, in accordance with previous studies on smooth-wall flows.

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