FM13L_10489

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Stability of Flow in a Rough Channel

J.M. Floryan[(1)], M. Asai[(2)]

(1) *Department of Mechanical & Materials Engineering, The University of Western Ontario, Canada*
(2) *Department of Aerospace Engineering, Tokyo Metropolitan Institute of Technology, Tokyo, Japan*

Stability of a two-dimensional flow in a channel with distributed surface roughness is considered. The reference geometry is defined as two-dimensional channel with one rough wall. The roughness is represented by a Fourier expansion. Explicit results are given for two case studies, i.e., roughness represented by a single Fourier mode (wavy wall model) and roughness in the form of spanwise grooves (grooved wall model). It is shown that the critical roughness wave number decreases from about 35 at roughness amplitude 0.001 to about 10 at roughness amplitude 0.01 in the case of wavy wall model. Analysis of grooved wall model shows that a very good approximation of the critical Reynolds numbers can be determined using only the dominant Fourier mode used to represent roughness geometry. Measurements carried out in the wavy wall case confirm theoretical predictions.

View the extended summary