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Modeling of the Gecko's skin microfibrillar structures using the Immersed Boundary method via DNS ISNARDO ARENAS, KENNETH CARRASQUILLO, U. of Puerto Rico, STEFANO LEONARDI, U. of Texas Dallas, GUILLERMO ARAYA, FAZLE HUSSAIN, LUCIANO CASTILLO, Texas Tech U. — There is a current interest in surfaces that mimic the skin of some species (i.e., sharks, dolphins and geckos) in order to achieve drag reduction. The surface considered is based on the microfribrillar structures of a gecko's skin (Aksak et al. 2008). The structures are modeled by means of the immersed boundary method proposed by Fadlun et al. (2000). Direct simulations are performed to predict flow dynamics with a Reynolds number of 7000 based on the height of the channel and centerline velocity. The ratio of the height of the structure with respect to the height of the channel is approximately 0.05. The main motivation is to study how the microfribillar structures affect the momentum transfer from the viscous layer to the outer layer. The surface shows a reduction of the area affected by the shear stress due to the cavities formed by the pattern. As expected, the cavities create a low velocity zone thus decreasing the Reynolds shear stresses. Lambda-2 and Q-criterion were implemented to identify the elongated streamwise vortices. The results show that when compared to a flat channel the microfribillar structures tend to preserve these streamwise vortices instead of bursting into the outer layer which is a source of drag increase.

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