Abstract

The present work studies, in detail, the unsteady wall-layer model of Walker et al. (1989, AIAA J., 27, 140 – 149) for the velocity profile in turbulent flows. Two new terms are included in the transcendental nonlinear system of equations that is used to determine the three main model parameters. The mathematical and physical feasible domains of the model are determined as a function of the non-dimensional pressure gradient parameter ($p^+$). An explicit parameterization is presented for the average period between bursts ($T^+$), the origin of time ($t^+$) and the integration constant of the time dependent equation ($A_0$) in terms of $p^+$. In the present procedure, all working systems of differential equations are transformed, resulting in a very fast computational procedure that can be used to develop real-time flow simulators.

Keywords

Law of the wall, turbulent boundary layer, unsteady model, feasible domain, asymptotic theory.