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Large-eddy simulations of the turbulent oscillating boundary layer¹ SENTHIL RADHAKRISHNAN, UGO PIOMELLI, University of Maryland, College Park — A turbulent boundary layer subjected to an oscillating pressure gradient has been computed using Large-Eddy Simulation with wall-layer models. Two types of wall-layer models were tested, one group based on log-law, another on the DES methodology. For the calculations using log-law wall model, the subgrid scale stresses were computed with the Smagorinsky, Lagrangian Dynamic and Scale-Dependent Lagrangian Dynamic models. Simulations were carried out for a Stokes Reynolds number $Re_{\delta_s} = 3500$. All the calculations predict the response of the wall-shear stress to the applied pressure gradient qualitatively well but with an error in the phase. The mean velocity is predicted reasonably well by all the calculations. During the late acceleration and early deceleration, the calculations based on DES methodology and those using the Smagorinsky model underpredict the streamwise and wall-normal Reynolds stresses whereas the Lagrangian Dynamic model gives improved agreement with the experiments.

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Senthil Radhakrishnan University of Maryland, College Park

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