Grid-point requirement for large eddy simulation: Chapman’s estimation revisited\(^1\) HAECHEON CHOI, Seoul National University, PARVIZ MOIN, Stanford University — Resolution requirements for large eddy simulation (LES), estimated by Chapman [AIAA J. Vol. 17, p. 1293 (1979)], are modified using accurate formulae for high Reynolds number boundary layer flow. This correction indicates that the number of grid points \((N)\) required for wall-modeled LES is proportional to \(R_{e_L}^{2/7}\), but a wall-resolving LES requires \(N \sim R_{e_L}^{13/7}\), where \(L\) is the flat-plate length in the streamwise direction. The number of grid points required for the flow over an aircraft using LES with and without modeling the viscous wall region is estimated: the number of grid points for the wall-modeled LES is one to three orders of magnitude smaller than that for the wall-resolving LES, indicating the practical importance of wall modeling in LES for high Reynolds number flows.

\(^1\)This work is conducted while HC takes a sabbatical year at Stanford University.