HIGH-ORDER PROJECTION-BASED UPWIND METHOD FOR IMPLICIT LARGE EDDY SIMULATION

PHILIP L. LEDERER, XAVER MOOSLECHNER, AND JOACHIM SCHÖBERL

ABSTRACT. We assess the ability of high-order (hybrid) discontinuous Galerkin methods to simulate under-resolved turbulent flows. The capabilities of the mass conserving mixed stress-yielding method as structure resolving large eddy simulation (LES) solver are examined. A comparison of a variational multiscale model to no-model or an implicit model approach is presented via numerical results. In addition, we present a novel approach for turbulent modeling in wall-bounded flows which can be interpreted as an extension of the classical variational multiscale idea to implicit LES via discontinuous Galerkin methods. This new technique called high-order projection-based upwind (HOPU) technique provides a more accurate representation of the actual subgrid scales in the near wall region and gives promising results for highly under-resolved flow problems. We consider the turbulent channel flow and periodic hill flow problem as well as a flow over an Eppler airfoil.

Keywords: Large eddy simulation, turbulence modeling, hybrid discontinuous Galerkin, mass conserving stress-yielding methods

Mathematics Subject Classifications (2010): 65N30, 76M10.

UNIVERSITY OF TWENTE, DEPARTMENT OF APPLIED MATHEMATICAS
Email address: `p.l.lederer@utwente.nl`

TU WIEN, INSTITUTE OF ANALYSIS AND SCIENTIFIC COMPUTING
Email address: `xaver.mooslechner@tuwien.ac.at`

TU WIEN, INSTITUTE OF ANALYSIS AND SCIENTIFIC COMPUTING
Email address: `joachim.schöberl@tuwien.ac.at`