Near-Wall Modelling of LES for non-equilibrium turbulent flows in an inclined impinging jet with moderate Re-number

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INTRODUCTION

Characterized by a strong wall/flow interaction process, impinging jets feature very complex flow properties. It is therefore not surprising that impinging flows are often used to validate turbulence models in the context of Large-Eddy simulations (LES). The majority of these studies were focused on a single jet impinging normally on a solid surface. Evaluation studies of oblique impinging jets are rare in the literature, even though this specific configuration is of practical interest in cooling arrangements for electronic components or gas turbine blades to reduce the size of such systems. This motivates the present work which deals with the evaluation of different near-wall modelling strategies for LES [1] of jet impinging on a solid surface with a particular inclination angle of 45° using OpenFOAM 2.4.0.

RESULTS AND CONCLUSION

The left figure shows the instantaneous turbulent flow field of the inclined impinging jet and the right one depicts the corresponding wall-shear stress induced by the jet on the wall obtained with different LES near-wall models in comparison with recent DNS data [2].
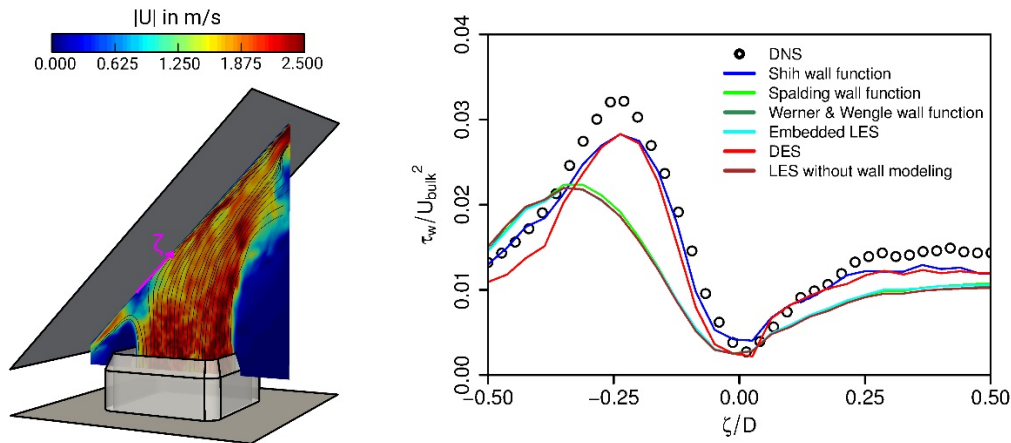
As it can be seen, especially the results obtained by non-equilibrium wall function based formulation of Shih et al. [3] provides the best agreement with DNS data while requiring relatively low computational cost. Other common approaches like DES or zonal LES show less predictive accuracy for such specific flows and require higher computational costs.

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