Mößner, M.; **Radespiel, R.**

Modelling of turbulent flow over porous media using a volume averaging approach and a Reynolds stress model. (English) Zbl 1390.76199

Comput. Fluids 108, 25-42 (2015).

Summary: A computationally efficient method to simulate high Reynolds number aerodynamic flows over porous surfaces is investigated. The approach is based on volume and Reynolds averaging of the compressible Navier-Stokes equations. Effects of the porous medium are modelled by the Darcy and Forchheimer terms. Turbulence is modelled by a Reynolds stress model with additional terms by virtue of present porous media. At the nonporous-porous interfaces a jump condition is applied to the momentum and turbulence equations. This correction models the effects of porosity gradients which are not considered in the derivation of the governing equations. Also, the implementation of the models into a compressible flow solver is described. Finally, the computational model is validated by comparisons with geometry resolved and volume-averaged DNS computations of a channel flow. Subsequently, the effects of the modelling parameters are analysed with respect to their sensitivities to the flow solutions.

MSC:

76F65 Direct numerical and large eddy simulation of turbulence
76S05 Flows in porous media; filtration; seepage
76Nxx Compressible fluids and gas dynamics, general
76D05 Navier-Stokes equations for incompressible viscous fluids

Keywords:

porous flow simulation; volume averaging; Reynolds stress turbulence modelling; stress jump conditions; porous channel with cubes

Software:

TAU

Full Text: DOI

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