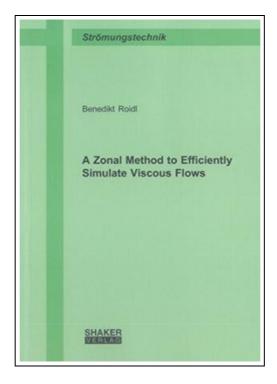
# A Zonal Method to Efficiently Simulate Viscous Flows



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Shaker Verlag Okt 2012, 2012. Buch. Condition: Neu. Neuware - Most of the industrial computational fluid dynamics (CFD) simulations at high Reynolds numbers are nowadays based on solutions of the Reynolds averaged Navier-Stokes (RANS) equations since they are simple to apply and computationally efficient. Therefore, they are used for the flow analysis at design and off-design conditions, for optimization, and largescale flow cases where experimental data may not be easily obtained. However, the numerical analysis of complex turbulent flow problems generally requires a higher order turbulence modelling in order to obtain a reliable solution. In most of the flow cases complex flow physics only appear locally which directly leads to the concept of a zonal method. This method simulates flow regions with increased complexity, e.g. a local recirculation zone, via an large-eddy simulation (LES) and the surrounding flow field which is characterized by an equilibrium boundary layer for instance by a RANS simulation. Particular attention has to be paid to the challenging coupling of RANS and LES domains. In this work methods are investigated that are applied to ensure an efficient transition of the averaged turbulent flow of the RANS domain to the three dimensional turbulent flow of the LES domain. Apart from already known synthetic turbulence generation methods an advanced ansatz is presented and thoroughly investigated. This ansatz projects the instationary velocity field at the inflow boundary of the embedded LES domain by superposition of coherent synthetic eddies. To ensure an efficient transition from synthetic to physical turbulence, the shape, the spectral properties, and the spatial composition of these synthetic eddies in a cluster of turbulent structures have to be precisely reproduced. To validate the synthetic turbulence generation method flatplate flows at a wide range of Reynolds and Mach numbers are investigated regarding the streamwise development of relevant flow...

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