

ACOUSTICS2008/2531

Direct aeroacoustic simulations based on domain decompositions

Jens Uitzmann and Claus-Dieter Munz

University of Stuttgart, Institute for Aerodynamics and Gasdynamics, Pfaffenwaldring 21, 70569 Stuttgart, Germany

For CAA, an accurate and feasible direct simulation that considers both the generation of sound within the flow and its propagation into the far-field is hard to realize with one numerical method in a single computational domain. On the other hand, a direct approach contains automatically the interaction of the acoustic perturbations with the flow-field, a property which lacks the popular acoustic analogy models. The proposed method is basically a direct simulation, but it simplifies the problem that has to be solved for individual regions in the computational domain. The idea is to use a non-overlapping domain decomposition method where the equations, methods, grids and even the time steps are adapted to meet the local requirements. Inside the coupling framework, high-order solvers from different classes of methods are available: On unstructured grids, a reconstructed ADER finite volume method (ADER-FV) is used for linear and nonlinear problems, as well as a discontinuous Galerkin method. On structured grids, the ADER-FV and the ADER-FD method are efficiently implemented for nonlinear (FV) and linear (FV, FD) problems. These high-order accuracy methods ensure excellent wave propagation capabilities throughout the entire computational domain. In the subdomains, the Navier-Stokes, Euler and the linearized Euler equations are solved.