Abstract Submitted
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An Evaluation of the Flow Simulation Methodology Using the NASA "Hump" Geometry DANIEL ISRAEL[1], HERMANN FASEL, University of Arizona — The Flow Simulation Methodology (FSM) is an approach for the simulation of turbulent flows in which a state of the art Reynolds averaged Navier-Stokes (RANS) model is rescaled using a contribution function. This allows the FSM to explicitly resolve only those scales of motion which are well represented on the computational grid while modeling the rest. We present simulations of the separated flow over a wall mounted "hump" with unsteady forcing, corresponding to case 3 from the NASA Langley Research Center Workshop: "CFD Validation of Synthetic Jets and Turbulent Separation Control." The turbulence upstream of separation is completely modeled, as in a RANS. In the separated region the FSM performs as a large or very-large eddy simulation. As with most hybrid methods, the FSM is slow in generating fine scale turbulence as it transitions from RANS behavior. However the large structures are well represented and the Reynolds stress distributions show good qualitative agreement with the experiments. The wall pressure fluctuations are relatively easy to capture, and are therefore not a good choice for evaluating turbulence models. Instead we examine the Reynolds stress produced by the phase averaged and the incoherent parts of the resolved motions. This suggests that the principle action of the FSM is to partition energy between the resolved incoherent motions and the model terms, with the strength of the large structures remaining relatively unaffected.

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