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A "true" Unsteady RANS model of turbulence with inherent forcing SUAD JAKIRLIC, ROBERT MADUTA, Darmstadt University of Technology, Institute of Fluid Mechanics and Aerodynamics, DARMSTADT UNIVERSITY OF TECHNOLOGY TEAM — Usually, a turbulence model designed and calibrated in the steady RANS (Reynolds-Averaged Navier-Stokes) framework has been straightforwardly applied to an unsteady calculation. It ended up in a steady velocity field in the case of confined wall-bounded flows; a somewhat better outcome is to be expected in globally unstable flows, such as bluff body configurations. However, only a weakly unsteady mean flow can be returned with the level of unsteadiness being by far lower compared to a referent database. Presently, an instability-sensitive, eddy-resolving model based on a differential, near-wall Reynolds stress model of turbulence is formulated and applied to several attached and separated wall-bounded configurations – channel and duct flows, external and internal flows separated from sharp-edged and continuous curved surfaces. In all cases considered the fluctuating velocity field was obtained started from the steady RANS results. The model proposed does not comprise any parameter depending explicitly on the grid spacing. An additional term in the corresponding length-scale determining equation providing a selective assessment of its production, modelled in terms of the von Karman length scale (comprising the second derivative of the velocity field) in line with the SAS (Scale-Adaptive Simulation) proposal (Menter and Egorov, 2010), represents here the key parameter.

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