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# SIMULATION OF AERODYNAMICS AND AEROACOUSTICS OF HELICOPTER MAIN ROTOR ON UNSTRUCTURED MESHES

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A method for helicopter main-rotor simulation is presented. It allows to simulate helicopter rotor aerodynamics and acoustics on unstructured meshes. The method is based on the finite volume approach to the discretization of Navier-Stokes equations on unstructured meshes using a higher-accuracy numerical scheme.

The method includes a set of key points, namely: 1) the Navier-Stokes equations in a rotating frame of reference with different turbulence-modelling approaches and wall functions for near-field flow simulation; 2) the all-Mach Riemann solver: 3) the higher-accuracy Edge-based Reconstruction (EBR) schemes [1,2] on hybrid unstructured meshes 4) the 1A Farassat formulation of Ffowcs Williams and Hawkings acoustic analogy assuming a control surface parameterised in the fixed frame of reference [3] for far-field noise prediction.

The method is validated on Caradonna&Tung [4] two-blades rotor aerodynamics case and on Kamov shrouded rotor ("Fenestron") problem. It is applied for simulating aerodynamics and aeroacoustics of several scaled helicopter main rotors including four-blades main rotor with twisted tapered swept 5-airfoils-based blade in hovering mode and four-blades main rotor in forward-flight mode.

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