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Characteristic-based Volume Penalization Method for Arbitrary Mach Flows Around Moving and Deforming Complex Geometry Obstacles[1] NURLYBEK KASIMOV, ERIC BROWN-DYMKOSKI, OLEG V. VASILYEV, Univ of Colorado - Boulder — A novel volume penalization method to enforce immersed boundary conditions in Navier-Stokes and Euler equations is presented. Previously, Brinkman penalization has been used to introduce solid obstacles modeled as porous media, although it is limited to Dirichlet-type conditions on velocity and temperature. This method builds upon Brinkman penalization by allowing Neumann conditions to be applied in a general fashion. Correct boundary conditions are achieved through characteristic propagation into the thin layer inside of the obstacle. Inward pointing characteristics ensure nonphysical solution inside the obstacle does not propagate outside to the fluid. Dirichlet boundary conditions are enforced similarly to Brinkman method. Penalization parameters act on a much faster timescale than the characteristic timescale of the flow. Main advantage of the method is systematic means of the error control. This talk is focused on the progress that was made towards the extension of the method to the 3D flows around irregular shapes.

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