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**A New Formulation of Brinkman Penalization Method for Compressible Flow Simulations in Complex Geometries**<sup>1</sup> QIANLONG LIU, OLEG V. VASILYEV, University of Colorado at Boulder — To simulate flows around solid obstacles of complex geometries, the volume penalization technique, called Brinkman penalization method, was proposed by Arquis and Caltagirone for incompressible viscous flows. Its main idea is to treat solid obstacles as porous media with porosity and permeability approaching zero. This is achieved by adding the penalization terms to the momentum equations. The straightforward extension of the method to compressible viscous flow is to penalize the momentum and energy equations. However, this extension produces unsatisfactory results, mostly due to unphysical wave transmissions into obstacles resulting in considerable energy and mass losses in reflected waves. In this talk, a new formulation of Brinkman penalization method for compressible flows is proposed. In addition to the penalized momentum and energy equations, the continuity equation for the porous media is considered inside obstacles. A sudden change in cross sectional area between fluid and modeled porous media generates a very large acoustic impedance ratio, resulting in ignorable wave transmissions. The new approach is applied to a number of one- and two-dimensional benchmark problems. The direct numerical simulation results for the full compressible high Reynolds viscous flows are in very good agreement with the exact solutions of the inviscid flows.

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