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Averaging-invariance of compressible Navier-Stokes equation SAWAN SUMAN, SHARATH GIRIMAJI, Aerospace Engineering Department, Texas A&M University, College Station, TX 77840 — While the averaging-invariance property of incompressible Navier-Stokes (iNS) is well documented; there is a need to formally establish the property for the compressible Navier-Stokes (cNS) equations. We put forth two new weighted-moment definitions and derive the averaging-invariant form of the continuity, momentum and energy equations for a general compressible flow. The averaging-invariant equations have the form of the Favre-averaged Navier-Stokes (FANS) equations and reduce to it in the appropriate limit. Furthermore, we derive the average-invariant forms of the evolution equations of various turbulent fluxes encountered in compressible turbulence. This formalization of the averaging invariance property is expected to contribute towards developing mathematically rigorous RANS-LES hybrid and/or bridging models.

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