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Symmetry Analysis of Probability Density Function Hierarchy in Compressible Turbulence[1] DIVYA SRI PRATURI, DOMINIK PLUEMACHER, MARTIN OBERLACK, Chair of Fluid Dynamics, TU Darmstadt — We perform symmetry analysis on the multi-point probability density function (PDF) hierarchy that governs the statistics of compressible turbulence. To this end, we utilize the PDF equations and side conditions derived from compressible flow equations that satisfy ideal gas law in the recent work of Praturi *et al.* (Phys. Fluids, **32**, 066102, 2020). The PDF equations (i) are integro-differential in nature; (ii) account for the statistics of density, temperature and pressure, in addition to that of the velocity field and do not make assumptions regarding the strength of fluctuations; and (iii) indicate a closure problem: the n-point statistics behavior is influenced by $(n+1)$- and $(n+2)$-point statistics. It is seen that the PDF equations and the side conditions, when viscosity and heat conductivity are zero, satisfy all the symmetries of compressible Euler equations including three scaling groups and kinematic symmetries. We also plan to derive all the Lie symmetries and corresponding invariant solutions, typically known as turbulent scaling laws. This approach is of great importance for compressible turbulence as there are very few works in the literature that undertake a similar approach.

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