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Similarity scaling in shock-turbulence interactions DIEGO DONZIS, Texas A&M University — The interaction of turbulence with a normal shock is an important problem of both fundamental and practical interest. While some trends are relatively established (e.g., turbulent kinetic energy amplification) quantitative predictions remain elusive when different flow conditions are considered. Data are typically compared with the Linear Interaction Approximation (LIA, Ribner 1953) which neglects the influence of Reynolds and turbulent Mach numbers, though data show that their effect is significant at conditions achievable in simulations and experiments. Without a suitable criterion to identify different regimes including what constitutes asymptotic states (e.g., high Reynolds number) one can come to varying conclusions from simulations and experiments. Similarity scaling is used to analyze available data of isotropic turbulence interacting with a normal shock wave. The proposed analysis suggests that incomplete similarity occurs for several parameters as opposed to complete similarity assumed in LIA. A combination of similarity parameters related to the shock thickness is found to be key even when it is small and, therefore, cannot be neglected. Within this theoretical framework, data on e.g., amplification factors and shock structure are found to present universal behavior in the proposed parameter which allows for identification of different regimes. Simple models based on these results can capture the scaling of the shock structure. Further implications of findings will be discussed.

Diego Donzis
Texas A&M University

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