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Normal shock wave attenuation during propagation in straight and branching ducts with grooves SEYED MEHDI MORTAZAWY, Embry Riddle Aeronautical University, KOSTAS KONTIS, School of Engineering, University of Glasgow, JOHN EKATERINARIS, Embry Riddle Aeronautical University — Experimental investigations and numerical simulations of normal shock waves of different strengths propagating inside ducts with roughness are presented. The roughness is added in the form of grooves. Straight and branching ducts are considered in order to better explore the mechanisms causing attenuation of the shock and the physics behind the evolution of the complex wave patterns resulting from diffraction and reflection of the primary moving shock. A well-established finite volume numerical method is used and further validated for several test cases relevant to this study. The computed results are compared with experimental measurements in ducts with grooves. Good agreement between high-resolution simulations and the experiment is obtained for the shock speeds and complex wave patterns created by the grooves. High frequency response time histories of pressure at various locations were recorded in the experiments. The recorded pressure histories and shock strengths were found in fair agreement with the two-dimensional simulation results as long as the shock stays in the duct. Overall, the physics of the interactions of the moving shock, and the diffracted and reflected waves with the grooves are adequately captured in the high-resolution simulations.

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