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Intermediate and High Strain-Rate testing of Soft Materials S.P. ANDERSON, E. PALAMIDI, J.J. HARRIGAN, University of Manchester — Strain-gauged bars are often employed as load cells for direct impact testing of materials and are incorporated within the split Hopkinson pressure bar (SHPB). Low impedance bars (e.g. magnesium or polymer bars) are desirable when testing soft specimens such as various energetic materials and cellular solids. However, due to the rheological properties of polymer bars, wave dispersion and attenuation occurs. For relatively large diameter bars and high frequency waves, geometrical wave dispersion due to radial inertia also occurs. As a result, the elementary one-dimensional wave theory can only predict accurately the propagation of stress waves along the bar within a limited frequency range. The spectral element method (SEM) is a powerful tool for the analysis of propagating stress waves in structures. In this paper the SEM is applied to the SHPB to obtain the stress-strain curves of specimens under investigation. To demonstrate the technique experimental results for balsa wood and aluminium foam using both magnesium alloy and PMMA bars are provided. Approximate four-mode rod theory applicable to viscoelastic bars is used to correct for geometrical dispersion. The results are compared with lower-order approximations.

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