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Weak Shock Wave Motion in Metals: A Theoretical Study

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Abstract: *Shock waves in metallic materials play an important role in high-pressure physics, impact engineering, and materials science. The propagation of weak shock waves in metals is particularly significant because it determines the early stages of stress wave evolution during dynamic loading. In this work, a theoretical study of weak shock wave motion in metals is presented. The governing conservation equations, Rankine–Hugoniot relations, and constitutive behavior of metallic materials are discussed. The propagation characteristics of weak shocks are analyzed under small perturbation assumptions where entropy changes are minimal. Theoretical approaches describing the relationship between shock velocity and particle velocity are discussed along with implications for material deformation and energy dissipation. The study highlights the importance of weak shock theory in understanding wave attenuation, elastic–plastic transition, and dynamic response of metals under high strain-rate loading.*

Keywords: Shock wave, weak shock, motion in metals, stress wave propagation, theoretical analysis