

Auxetic Metamaterials for Seismic Wave Mitigation: A State-of-the-Art Review of Recent Literature

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Abstract. Auxetic metamaterials with negative Poisson's ratio (NPR) have gained attention for their potential in low-frequency seismic wave attenuation and earthquake-resistant construction. This review explores recent advancements in auxetic metamaterials for seismic engineering, focusing on their wave suppression mechanisms, structural reinforcement, and energy dissipation capabilities. Numerical simulations and experimental studies demonstrate significant improvements in bandgap widths, vibration damping, and seismic acceleration reduction when using NPR-based metamaterials. These materials have been successfully integrated into base isolators, shear walls, and bracing systems, showing superior mechanical performance compared to conventional materials. However, challenges remain in terms of large-scale implementation, economic feasibility, and long-term behavior under repeated seismic loading. This review highlights key advancements, current limitations, and future research directions, emphasizing the potential of auxetic metamaterials in next-generation earthquake-resistant infrastructure.

