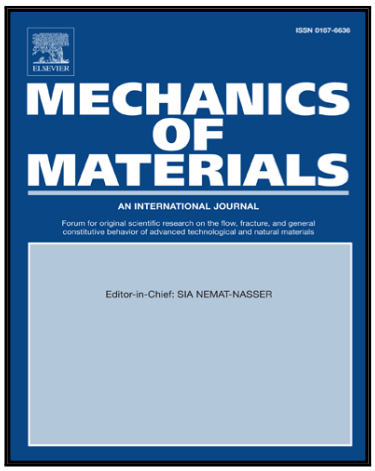

On elastic waves in granular assemblies: from a continuumnization viewpoint

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Highlights

- A novel continuumnization technique is applied to study elastic waves in assemblies of spherical particles in 3D lattices.
- Macroscopic material properties are presented in neat tensor forms, determined by the micro-mechanics (the spring constants) and the microstructures (fabrics) of the lattices.
- Theoretical wave velocities for p- and s-waves, the frequency for the pure spin mode and the group velocity for the spin motion coupled with s-waves, are derived.
- The influence of spring constant ratios on the wave velocities and on the anisotropy is examined.
- The similarity is revealed between the coupled s-wave and spin motion in the lattices and the acoustic and optical branches of waves in the diatomic model in solid-state physics.
- We found out that anisotropic close-packed lattices would degenerate to a special isotropic state with a zero Poisson's ratio and a constant velocity ratio of between p- and s-waves.
- The theoretical results obtained are useful for quantitative verification and for parameter calibration of discrete-element-method simulations using spherical particles.