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Wave propagation in geomaterials in the presence of rotation-induced negative stiffness

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Rotational degrees of freedom in geomaterials reflect the ability of constituents to rotate independently. If the constituents are not strictly spherical (or circular in 2D) then their rotation causes the effect of apparent negative stiffness and can be interpreted as negative shear modulus. In order to study the mechanism of stability of geomaterials we use experimental results of a designed inverted pendulum comprising negative stiffness elements. Understanding of wave propagation in geomaterials with apparent negative stiffness has significant importance, especially for interpretation of the results of seismic exploration. In particular this can provide a method for the detection of the pressure of rotational degrees of freedom and insight into the degree of fragmentation. Wave can propagate in such a material if the boundary conditions stabilise the geomaterial. We investigate the values of the negative shear modulus allowing the p- and s-waves propagate. We then numerically model the propagation of initial impulse with the account for the effect of negative stiffness.