The influence of architecture on the deformation localisation of cellular materials

Abstract

In general cellular materials fail by localisation of deformation. For random cellular materials, the localisation plane due to compressive deformation is found to be perpendicular to the applied stress. For periodic cellular materials, however the localisation occurs in particular directions that are related to the underlying "crystallography" of the cellular architecture. In this contribution we treat the deformation localisation like a martensitic instability, that is a deformation corresponding to a "soft" elastic deformation mode. The model of Khachaturyan is applied to different cellular architectures both in two and three dimensions.

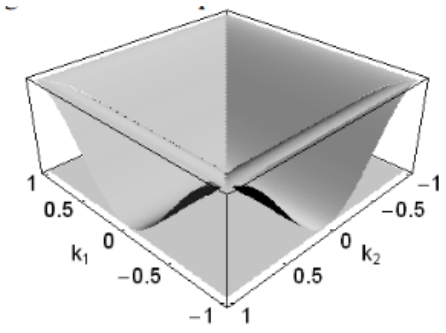

Figure 2a: Surface of the three eigenvalues of the reciprocal stiffness matrix of a square lattice as a function of wave vector $\mathbf{k} = (k_1, k_2)$

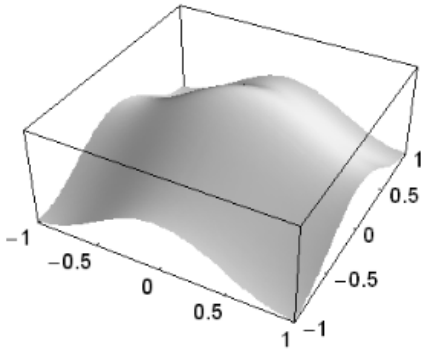

Figure 2b: Surface of the smallest eigenvalue of a square lattice as a function of wave vector $\mathbf{k} = (k_1, k_2)$