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USE OF CRYSTALLOGRAPHIC SYMMETRIES FOR TOPOLOGY DESIGN OF EXTREME ISOTROPIC ELASTIC METAMATERIALS

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Abstract. Most known 2D extreme mechanical metamaterials in literature display a certain level of order in their topology. This fact seems to reflect that order is needed to achieve extreme behaviour and it is reazonable to expect the same in the 3D case. In our porpous of designing periodic microarchitectures we count with crystallography that describes, through plane and space groups, every combination of symmetry elements for 2D and 3D crystals, thus provide with all the alternatives of order. The connection between the geometrical and physical parts comes from Neumann's principle, which establishes that the effective properties of the composite inherit, at least, the symmetry of the material configuration. This work explore the effect of the imposition of several plane and space groups to the topology, within a problem of inverse homogenization, and show that symmetry election is relevant to bring near the theoretical limits of elastic properties (Cherkaev-Gibiansky for 2D and Hashin-Shtrikman for 3D).