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Computational multiscale modeling of sheet-layered lamination stacks

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The prediction of the deformation behavior of sheet-layered lamination stacks used in electric motors as rotor and stator is a challenging task in structural mechanics due to the special microstructure. Especially the individual sheet interactions play an important role in the macroscopic response of these material. The manufacturing process of such components determines the nature of the interfacial area, e.g. the presence of bonding varnish or frictional contact between individual sheets.

In this work, a transveresely isotropic constitutive model depending on the actual microstructure is presented, which can sometimes be derived analytically, mostly with the help of numerical homogenization. While the sheets are assumed to be isotropic, the contact interaction between single sheets is covered by Zero-Thickness-elements, in which different constitutive equations can easily be implemented. Possible choices of these functions as well as the variation of corresponding parameters are shown to outline the effect on the macroscopic constitutive quantities.

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