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A COMPARISON OF TWO MESO-MODELS FOR DRY-WOVEN FABRICS AND THEIR MULTISCALE EQUIVALENTS

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Because dry-woven fabrics are important for several technological applications, numerous constitutive macroscale models and discrete mesostructural models for them can be found in literature. Mesomodels using springs have the advantages that (i) they are rather straightforward, (ii) the influence of mesostructural parameters can directly be investigated and (iii) the behaviour of a single yarn can be altered and investigated [1]. Almost all meso-models based on springs use an X-braced lattice structure: yarn segments are represented by horizontal and vertical springs and the spring nodes are located at the yarn-to-yarn contact points of horizontal and vertical yarns. The diagonal springs in these models represent the rotational stiffness that comes into play when horizontal and vertical yarns rotate relative to each other. The rotational stiffness is initially governed by the friction in the yarn-to-yarn contact points (and hence, the response of the diagonal springs is initially negligible compared to those of the horizontal and vertical springs). For large rotations however, horizontal and vertical yarns are completely in contact with each other and start to compress each other (and hence, the response of the diagonal springs becomes more pronounced for large shear deformations). The downside of this is that when substantial biaxial deformation (without rotation) occurs, the diagonal springs influence the results significantly. To avoid this inaccuracy, rotational springs can be used instead. In this presentation, an X-braced spring mesomodel will be compared to a mesomodel in which the diagonal springs are replaced by rotational springs. The results are significantly different, but some disadvantages of the use of rotational springs will also be mentioned. A substantial part of the presentation will furthermore be dedicated to the multiscale quasicontinuum method to upscale the mesomodels in order to achieve efficient macroscale computations [1].

REFERENCES

[1] Beex et al., The mechanical reliability of an electronic textile investigated using the virtual-power-based quasicontinuum method. *Mech. of Mat.*, Vol. **80**, 52-66, 2015.