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LOCKING AND STABILITY OF 3D TEXTILE COMPOSITE REINFORCEMENTS DURING FORMING

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Summary: A hyperelastic constitutive law for 3D layer to layer angle interlock preforms is proposed. This model is macroscopic and aims to determine the strains and stresses of the whole 3D preform. The strain energy potential is defined for elementary deformation modes. The dependence of the strain energy potential on the material privileged directions can be introduced explicitly. Structural tensors representative of the anisotropy of the material are introduced. 3D interlock fabrics are made of warp and weft yarns which are perpendicular to each other in the initial configuration. The 3D material has three privileged directions: the warp directio, the weft direction and a third direction through the preform thickness. The constitutive law has proven to be effective but the finite element formulation into which it is implemented may be spurious in some cases. Enhancements in order to avoid these problems will be presented.

References:
[1] A. Charmetant, J. G. Orliac, E. Vidal-Sallé, P. Boisse, Hyperelasticmodel for large deformation analyses of 3D interlock composite preforms, Compos Sci Technol, 72 (2012) 1352?1360.
[2] X. Yu, B. Cartwright, D. McGuckin, L. Ye, Y.-W. Mai, Intra-Ply shearlocking in finite element analyses of woven fabric forming processes, Compos. Part A, 37 (2006) 790-803.
[3] R. H. W. ten Thije, R. Akkerman, Solutions to intra-ply shear locking in finite element analyses of fibre reinforced materials, Compos. Part A, 39 (2008) 1167?1176.2]
[4] N. Hamila, P. Boisse, Locking in simulation of composite reinforcement deformations. Analysis and treatment, Compos. Part A, 53 (2013) 109-117.
[5] J. Pazmino, S.Mathieu, V. Carvelli, P. Boisse, S. V. Lomov, Numerical modelling of forming of a non-crimp 3d orthogonal weave e-glass composite reinforcement, submitted to Compos. Part A.