Numerical modelling of rubberlike materials using pure shear test data

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SUMMARY

The Neo-Hooke, Mooney-Rivlin and Van der Waals (Kilian) models describing pure elastic behaviour of rubberlike materials are compared. This paper examines when and under what conditions it is possible to predict experimental stress-strain curves using considered models. Stress-strain curves are derived from pure shear (biaxial) tests using specimens of SBR vulcanizate covering a wide range of deformation. Analyses proved that by using Kilian it is possible to predict the actual behaviour of rubber submitted to pure shear loads for the entire range of applied deformation. Neo-Hooke and Mooney-Rivlin models are satisfactory in the compression and moderate tension. The analysis pointed out that the influence of the approximation range of deformation (measured as extension ratio) upon the value of model parameters is very strong. Acceptable results were obtained with all investigated models only if the approximation range was properly chosen. These results were obtained by means of FEA simulation of axial loading of two real rubber products, and they were compared with the results of the loading experiment. The ABAQUS software package was used in the analysis. All the considered models were implemented in this software as subroutines.