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Modelling of the Induced Anisotropy by Mullins Effect

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ABSTRACT

During cyclic loading, rubber like materials exhibit a stress-softening phenomenon known as the Mullins effect. In the last few years, some constitutive equations have been proposed to deal with this effect including induced anisotropy, but all these models rest on few experimental data. In that respect, data on filled silicone rubber were presented for classical uniaxial, planar and biaxial tensile tests [1]. More recently, the same authors used uniaxial and biaxial tests to precondition samples inducing some primary stress softening. Next, uniaxial tensile tests were conducted on preconditioned samples[2].

An analysis of these data permits to highlight that two phenomena are observed, first the maximum elongational energy in the maximum principal direction is the governing parameter that defines the return point on the virgin loading curve. Second, the relation of the elongational energy in each direction with the maximum elongational energy permits to describe the amount of stress-softening.

A new generic form of constitutive equation[3] is proposed by taking into account the two previously cited parameters. The model is built by considering that the material can be modelled by superposing an hyperelastic network and an evolving one which takes into account the induced anisotropy of the Mullins effect by means of a decomposition of the chain network according different directions.

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References

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