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CONSTITUTIVE MODELLING AND PARAMETER IDENTIFICATION OF HIGHLY EXTENSIBLE POLYUREA

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Polyurea is a high performance elastomer usually used as a protective coating on steel or concrete. The elastic properties of Polyurea were identified in a recent work, where in uniaxial tension an elastic modulus of ≈ 65MPa was measured together with an elongation up to $\approx 650\%$. In this work we present a constitutive model for the viscoelastic behavior of Polyurea as well as a characterization of the damage.

For the viscoelastic part, several relaxation experiments are performed. From the measured data a general viscoelastic model is derived where we use two different approaches. At first we identify a general Maxwell model (combining spring and damping elements for finite deformations) to use a prony series with N elements, which requires the identification of $2N + 1$ parameters. At second, a model of generalized fractional elements is employed. Both approaches are studied in detail and are compared to data from literature.

Damaging effects of Polyurea are investigated in the quasistatic regime using tensile tests with and without cyclic loading. In particular we focus on the the onset and growth of damage based on cavitation. To this end the recovered specimens are analyzed using a laser microscope; the surfaces of the ruptured areas are compared in terms of quantity and size of voids. From the gained data, we derive a model to describe the cavitation inside the material.