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INELASTIC FINITE STRAIN ASPHALT MODEL INCLUDING DAMAGE AND HEALING – IMPLEMENTATION INTO COUPLED TIRE-PAVEMENT-SIMULATIONS

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The heterogeneous structure of asphalt materials that are usually composed of mineral grains, bitumen, fillers and additives causes its complex material behaviour. While the short-term material behaviour is dominated by temperature dependent viscoelasticity, the long-term behaviour is further characterized by plasticity as well as damage and healing. To enable realistic predictions of the performance and lifetime of asphalt pavements, a material model that captures the mentioned properties is required.

Finite strain asphalt material models that include temperature dependent viscoelastic and plastic behaviour have been previously proposed e.g. by [1], [4]. This contribution at hand presents a thermodynamic consistent formulation for the damage and healing behaviour. Material parameters are identified based on experimental data of cyclic tension-compression-tests of asphalt specimens. The asphalt material model is implemented into a finite element pavement model, which bases on an arbitrary Lagrangian-Eulerian (ALE) formulation [2], [3]. The ALE formulation introduces a reference frame that moves with the tire through the space. In case of steady state rolling tires and a pavement, which is homogeneous in driving direction, the deformation state of the tire and the pavement with respect to the introduced moving ALE reference frame becomes time-independent. This feature enables a numerically efficient description of the tire-pavement interaction. The coupled tire-pavement-simulations allow the investigation of damage and healing evolution in pavements under loading of rolling tires.

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