DEM simulation of asphalt under flow and compaction using a new mechanics-based viscoelastic contact law

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ABSTRACT

To construct durable roads, it is of utmost importance that the asphalt mixture has an optimal composition of binder and stones of different sizes as well as the right mixture temperature. Here, the Discrete Element Method (DEM) is a very useful tool to investigate flow and compaction properties of the mixtures. To obtain accurate predictions from the DEM simulations the contact law, i.e. how the contact forces are calculated between two asphalt particles is of utmost importance.

Asphalt is often modelled in DEM using a viscoelastic contact law. However, the existing viscoelastic models in DEM are phenomenological in nature with no clear connection between contact law parameters and the constitutive properties of the binder and the stones. Hence, a new viscoelastic contact model, based on contact mechanics considerations, has been developed recently [1]. In this work, this model is extended for asphalt materials by modelling the asphalt particles as elastic stones surrounded by a viscoelastic layer having a thickness to provide the given binder content.

The accuracy of the extended contact model is validated using FEM. Simulations using DEM are performed using different asphalt mixtures at different temperatures at two different important load cases; gyratory compaction and compaction flow test [2] to critically evaluate the predictability of the DEM model.

REFERENCES