Viscoelastic Modelling of Road Deflections for use with the Traffic Speed Deflectometer - DTU Orbit (12/08/2019)

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This Ph.D. study is at its core about how asphalt and road structures respond to dynamic loads. Existing models for the deflections under a moving load using beam equations are revisited and it is concluded they leave room for improvement for the particular setup and problem at hand. Then a different approach is set up to model visco-elastic deflections starting from the physically based framework of continuum mechanics by using Finite Element Methods (FEM) combined with the Laplace transform.

It is shown that this approach coincides with a more standard time-stepping FEM setup in the case of a generalized Maxwell model.
Validations by comparison to ViscoRoute simulations are also made.
This justifies the use of the Laplace FEM for generating simulated data using a Huet-Sayegh model for the visco-elastic behaviour of asphalt.
These simulated data, along with measured data, are then used to suggest an approach for a computationally simpler synthetic model capturing essential behaviour of deflection basins under a moving wheel.

Additionally the setup allows for simulated comparisons of the cases of loadings emulating the use of a Falling Weight Deflectometer with loadings emulating a moving wheel as in the case of using a Traffic Speed Deflectometer. The flexibility of the method also allows for looking into cases excluded by imposing simplifying assumptions such as the structure imagined to be an infinite halfspace.

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