Viscoelastic Modelling of Road Deflections for use with the Traffic Speed Deflectometer - DTU Orbit (29/12/2018)

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 viscoelastic 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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