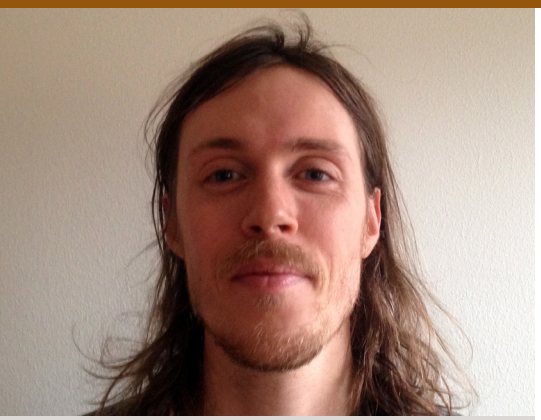
MASTER'S DISSERTATION AT STRUCTURAL MECHANICS

DEPARTMENT OF CONSTRUCTION SCIENCES | FACULTY OF ENGINEERING LTH | LUND UNIVERSITY



JAKOB SJÖSTRAND

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SUPERVISOR

Professor PER-ERIK AUSTRELL
Div. of Structural Mechanics, LTH

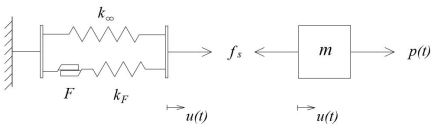
EXAMINER

Professor KENT PERSSON
Div. of Structural Mechanics, LTH

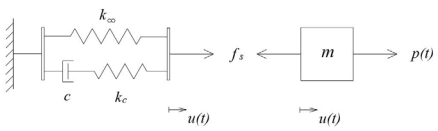
THE WORK IS PERFORMED AT

THE DIV. OF STRUCTURAL MECHANICS, LTH

SOME DEVIATIONS FROM LINEAR DYNAMICS DUE TO MORE ACCURATE DAMPING MODELS



SFS model



SLS model

Damping is present in all dynamic systems. In one way or another energy is being dissipated in the system. To capture this in a computational model is a difficult task. A common simplification is to assume that the damping is of a linear viscous nature. This assumption provides an equation of motion (linear dynamics) which is easy to handle mathematically. However, the simplicity of linear dynamics can in turn result in a poor representation of the physical reality. Perhaps the material is not viscous, perhaps friction is present either inside the material or at the boundaries?

Different damping models can take different damping phenomena into account, and it could be wise to work with a model or a combination of models that represent the physical properties of the material in the best way possible. The main idea of the thesis is to show how more realistic viscoelastic material models and the inclusion of frictional effects will give rise to various nonlinear dynamic phenomena.

The thesis will present and discuss a number of existing material models and different physical aspects connected to them. For example, rate dependence/independence, amplitude dependence/independence, linearity/non-linearity. Some examples of material models that will be investigated in a dynamic context are the standard linear solid model, the Kelvin-Voigt model, and the Coulomb friction-model. Numerical time-stepping procedures using the central difference method will be applied in order to evaluate the different models. Initially single degree of freedom systems will be analyzed. The material models will then also be applied to multi degree of freedom systems such as a three story shear building.

DIVISION OF STRUCTURAL MECHANICS
Faculty of Engineering LTH, Lund University, Box 118, SE-221 00 Lund, Sweden
• Tel: + 46 (0)46-222 73 70 • Fax: + 46 (0)46-222 44 20 • www.byggmek.lth.se

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