Lucerne University of
Applied Sciences and Arts

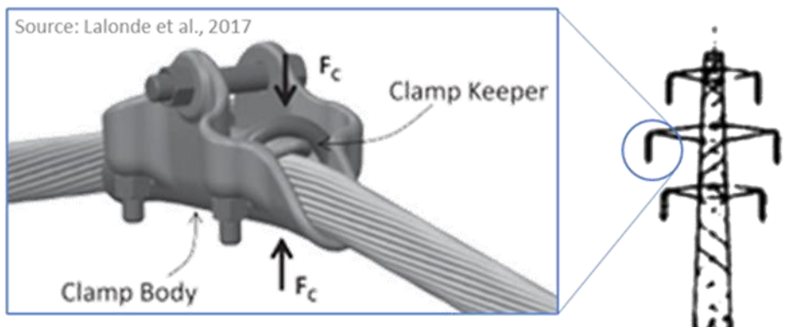
HOCHSCHULE
LUZERN

Technik & Architektur
FH Zentralschweiz

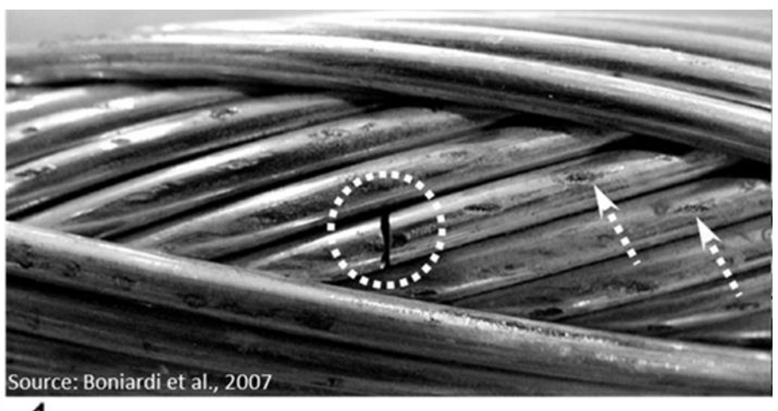
MSE | MASTER OF SCIENCE IN ENGINEERING

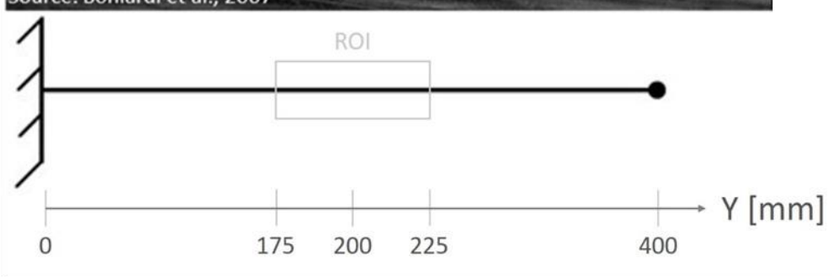
Master-Thesis Engineering, Profile Industrial Technologies

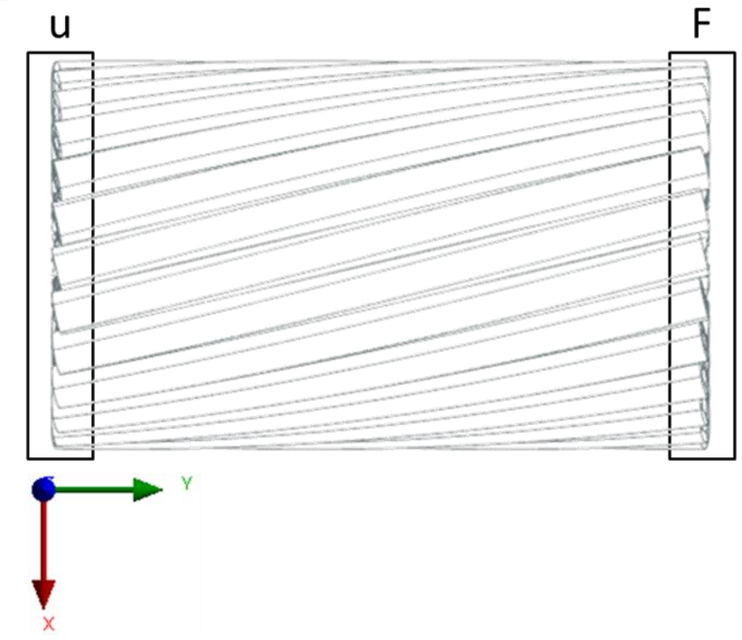
Computation of Stresses in Overhead Line Conductors

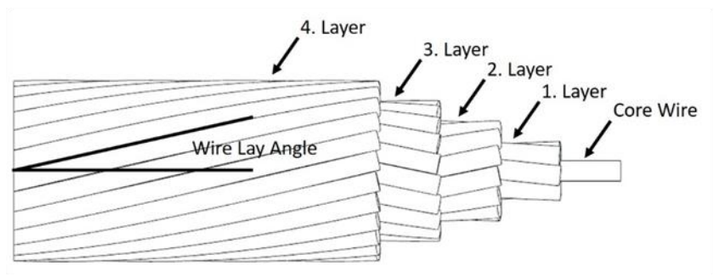


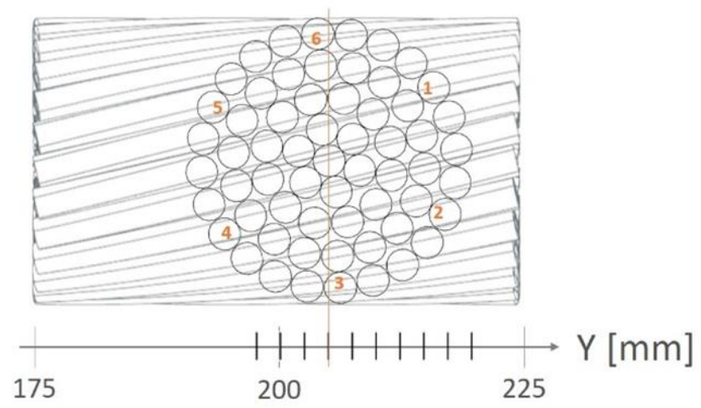
Source: Laughton and Warne, 2002

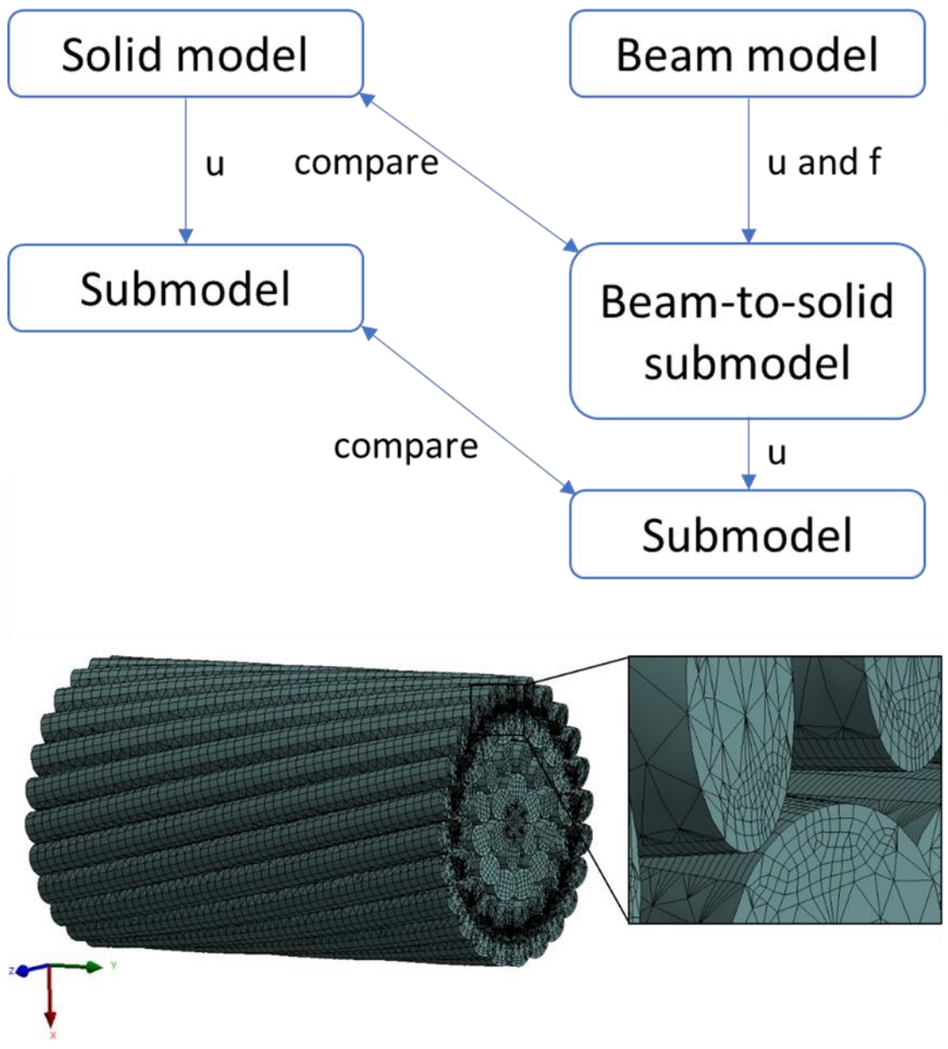


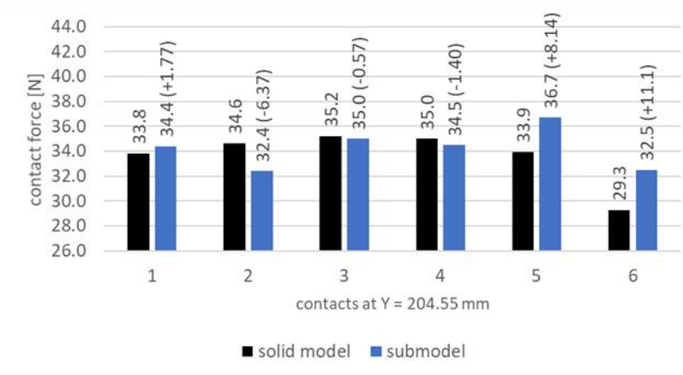


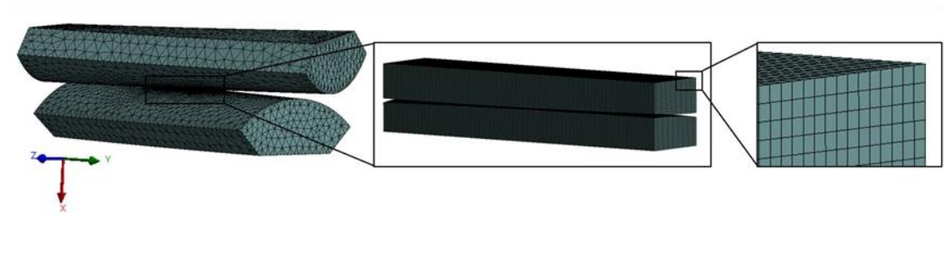


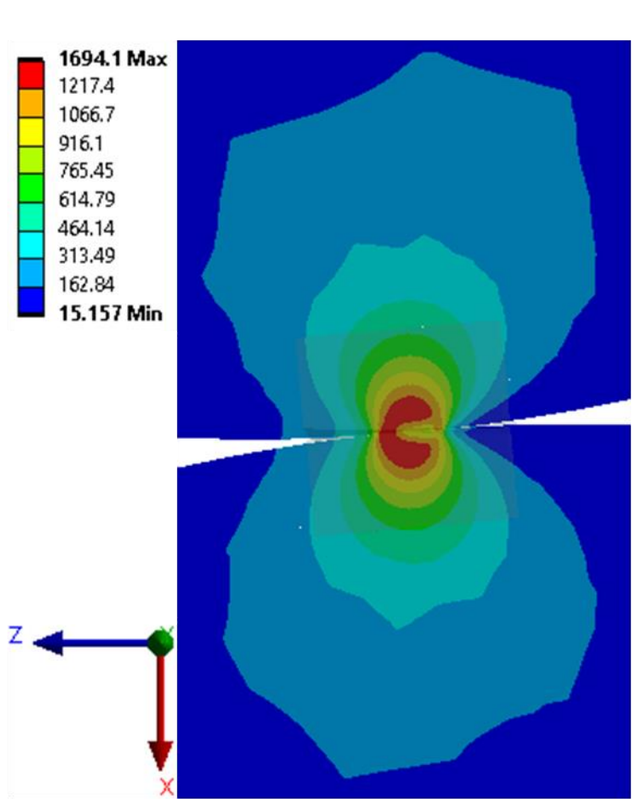












Situation

This master's thesis deals with the numerical computation of stresses in overhead line conductors. Various finite element simulation approaches to determine the stresses in the contacts between the individual conductor wires are being developed and investigated.

Mainly the contacts between the crossing wires of the two outermost layers in multi-layered conductors are of interest. They are considered critical and prone to cracking, which can lead to fatigue failure. The stresses calculated in the contact region can serve as an input variable for models that calculate the service life of overhead line conductors. As a result, service intervals can be better defined, which serves to prevent wire breaks and power failures.

Approach

The beam-to-solid submodelling technique is used. A solid finite element model of the region of interest is created based on an efficient beam model of an overhead line conductor by transferring boundary conditions. Displacements from the beam model are transferred at one end of the submodel and forces at the other end.

A local solid-to-solid submodel of a single contact is used in a further step. Starting with the models of a single-layered conductor on which the line contact is examined, the models are gradually expanded. The point contact is examined in detail using models of a two-layered conductor. The multi-scale approach developed in this way to simulate the stresses in the contact region is then implemented on models of a four-layered overhead line conductor.

With the developed beam-to-solid-to-solid submodelling approach, the contact forces and stresses that are simulated with a corresponding solid finite element model can be reproduced with a deviation of less than twelve percent for single-, two- and four-layered overhead line conductors.

The investigations are limited to a few load cases. In order to provide broader support for the multi-scale approach that has been developed and thus demonstrate its justification for simulating an input variable for service life models, further studies of various relevant load cases and a validation of this approach are necessary.

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