# Multiphysical Simulation of Moved Data Cable

M. Raum
Friedrich-Alexander Universität, Erlangen, BY, Germany

**Introduction**: The question for this simulations was, how the electric and magnetic characteristics of an data cable change through the mechanical deformations in case of moved application. An overly simplified model was created to explore some basic changes going on.

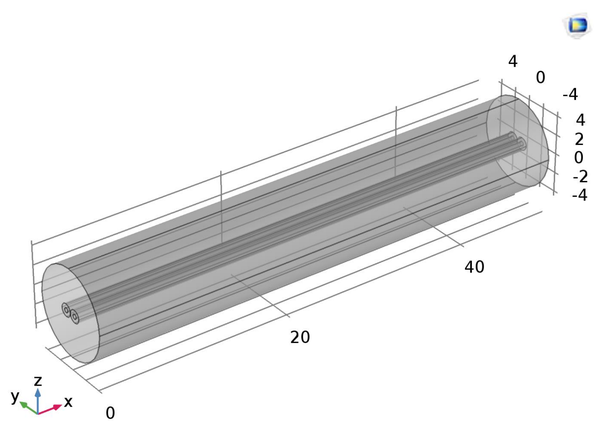


**Figure 1**. simplified model of the data cable

**Computational Methods**: To solve for the desired electric and magnetic values, both the static electronic module (es) an the electric an magnetic fields module (mef) were used. Combined with the structural mechanics module the dependencies between mechanical deformation and electro-magnetic changes were discovered. The main aim was to simulate the capacitance and the inductance.

$$C' = \frac{C}{l} = \frac{\varepsilon_0 \varepsilon_r \pi}{ln(\frac{2D}{d})} \qquad L' = \frac{L}{l} = \frac{\mu}{\pi} ln\left(\frac{D}{d}\right)$$

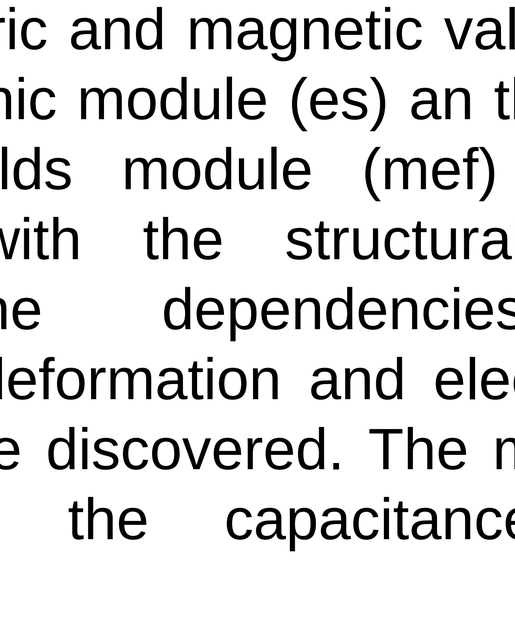

**Figure 2**. Bending with boundary load

**Results**: The bending of the cable, increased the distance between the conductors, independent of the bending direction. Therefore the inductance and capacitance changed in the way the distributed resistance decreased over the load.

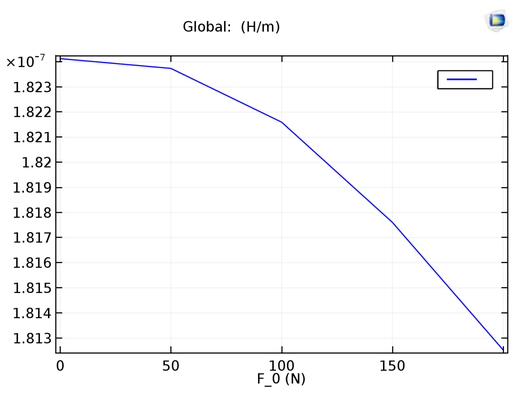


**Figure 3**. Inductance over load

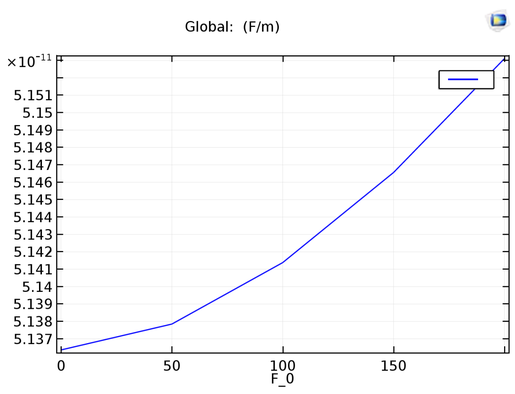


**Figure 4.** Capacitance over load

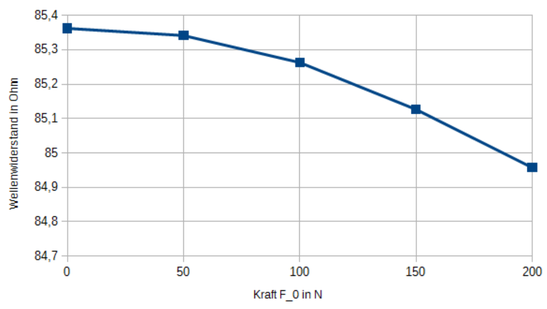


**Figure 5**. Distributed resistance over load

**Conclusions**: As expected the conducting properties of an data cable worsen over the load. Especially in high frequency applications this effects could have an important impact.

## References:

1. Frank Gustrau, Hochfrquenztechnik, Carl Hanser Verlag (2013)
2. Manfred Albach, Elektrotechnik, Pearson Deutschland GmbH (2011)