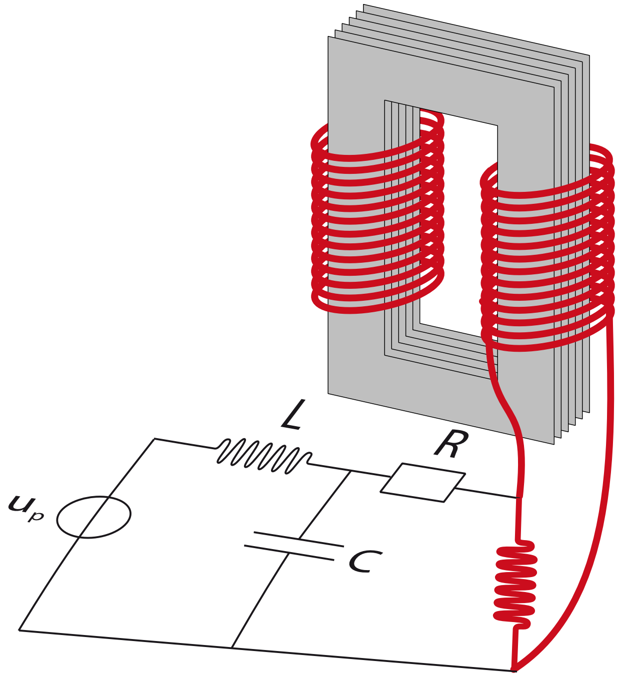
GRADUATE SCHOOL
computational engineering

TECHNISCHE UNIVERSITÄT DARMSTADT

Subject: Adaptivity for dynamic iteration methods

Research Focus/ Cross-sectional Area: Multirate and multiscale methods



Description:

Most multiphysical problems (for example, the heating up of an electromechanical energy transducer coupled to an electrical network) require the transient simulation of coupled systems of differential equations.

Dynamic iteration methods are a generalization of the classical static iteration methods for linear equations (e.g. the classical 'Gauß-Seidel' method) for coupled system of differential equations. The time interval of interest is split into smaller windows (macro steps), on which the individual subsystems are solved by a time-stepping method (using micro steps). This allows automatically different step size towards each subproblem (multirate). After exchanging information, the simulation of each subproblem is repeated until convergence is reached (sweeping).

In this project a control mechanism shall be developed that controls the parameters of a dynamic iteration scheme adaptively, i.e., to reduce the splitting error, either the macro step size can be decreased or the number of iterations can be increased. Both approaches will yield to a more precise solution at higher computational costs but which approach is to be preferred?

Requirements:

An excellent Master's degree in engineering or mathematics. Knowdledge in basic physics (electromagnetics), network related modeling, space and time discretization (FEM, Runge-Kutta), model order reduction (e.g. POD) and programming skills e.g. Matlab are beneficial.

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