

Mathematics, Numerics, and Applications of Coupled Field Theory

Roderick Melnik
Mads Clausen Institute
University of Southern Denmark
email: rmelnik@mci.sdu.dk

Abstract

All material systems interact in some way with their environment, and a given material system may be of any degree of complexity with components interacting with each other. When a mathematical model for such a system is constructed it is our skills, experience and our prior scientific knowledge of the system that allow us to decide on the form and relative importance of these interactions. In this talk I will focus on the mathematical modelling of coupled systems whose components interact dynamically so that their response should be obtained concurrently. One of the examples that will be discussed is aimed at a systematic description of nonlinear behaviour of materials with memory, in particular shape memory alloys. I will also demonstrate some results of computational experiments with models ranging from macroscopic climate models to models of sub-micron semiconductors and quantum devices which are unified by the fact that dynamic coupling effects keep the key to a better understanding of phenomena and processes involved.