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COMPUTATIONAL ELECTRO-MAGNETO-THERMO-MECHANICS

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ABSTRACT

Electromagnetic effects exist in many areas of everyday life, especially in all devices powered by electricity. Particularly in the field of novel engineering and science applications, it is of crucial importance to investigate the mechanical and thermal effects that are caused by the electromagnetic fields. Electromagnetic fields are becoming more and more demanding, as manufacturing tolerances due to efficiency in industry are constantly being raised to a new level and also people are nowadays very sensitive to the impact of these fields on humans. Important topics in today's era, where electromagnetic phenomena are of crucial relevance, are reflected in the field of wind energy systems and e-mobility. While, in the example of wind energy power plants, a generator produces electricity by the wind forces, electric motors use this electricity to operate them, for example driving an electric car. In both examples, components move inside the generator/motor and, due to the rotating rotor in the stator, highly dynamic electromagnetic fields interact with a mechanical field. In addition to the generation of mechanical energy into electrical energy or the utilization of electrical energy in mechanical energy, the exploitation of highly dynamic electromagnetic interactions in the field of the production of functionally graded materials is also given. Here, special phenomena of the electromagnetic interaction are exploited in order to generate specific properties in the temperature development depending on the functionallity in locally defined areas.

The present symposium will deal with electro-magneto-mechanical, as well as electro-magneto-thermal phenomena and their interactions. The symposium deals in the foreground next to the physical phenomena also with the mathematical, mechanical and algorithmic aspects and engineering applications of these multi-field problems. Especially in the area of highly nonlinear material properties, there is a strong coupling of all fields which require special methods for solubility. The numerical implementation and corresponding techniques will be discussed here. In addition, studies on high-order numerical methods in space and time as well as stability and accuracy are to be investigated with regard to electromagnetic phenomena with the effect on other physical fields. These high-order numerical methods in space and time require high computing capacity, so that the numerical effort cannot be disregarded. Consequently, high performance computing of multiphysics will also adressed within the present mini symposium. Since the underlying multi-field problems are subject to a weak or even strong coupling, strategies with regard to a monolithic or partitioned solution can also make a valuable contribution, since in this case as well, the above-mentioned highly accurate numerical methods require additional attention in space and time.