A partitioned solution approach for strongly coupled multifield problems

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Dienstag, 26.02.2019, 13:30 Uhr
Zentral-Campus, Pockelsstr. 3, Seminarraum 0017

A flexible and generic framework for the numerical solution of strongly coupled multifield problems will be presented. The application of a partitioned approach enables the use of different numerical methods, discretizations and solvers for the individual fields. In this way, optimized, existing software can be reused, increasing the efficiency of the simulation. Due to the nature of the partitioned approach, the coupling of the different solvers for the individual fields calls for methods that support an accurate data transfer and help to stabilize and accelerate the overall solution process. For the acceleration of the partitioned solution approach different variants of the quasi-Newton least squares method are further developed. The numerical methods for the data transfer and convergence acceleration are implemented in our software framework comana, which facilitates the application of different coupling strategies for a vast range of multifield problems. The interaction with different solvers is achieved through a uniform interface to the solvers’ databases. The software framework comana has been successfully applied to the solution of different multifield problems. We will present several applications demonstrating the flexibility of our approach. The problems to be considered include electro-thermo-mechanical coupling which is of interest, for example, in field-assisted sintering technology. Furthermore we will address the partitioned solution of fluid-structure interaction problems which arise in many different engineering disciplines. The applications we will present range from the analysis of blood flow in arteries to maritime applications, where complex situations such as the landing manoeuvre of service ships to offshore wind turbines are simulated.