

Design and evaluation of a waveform iteration–based approach for coupling heterogeneous time stepping methods via preCICE

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For multiphysics simulations the robust and accurate coupling of different simulation codes is often required. Code coupling libraries, such as preCICE [1], allow the user to easily couple codes following a data-driven black-box approach, which ensures high flexibility and ease-of-use. However, the coupling of simulation codes that are working on different time-scales or using different time stepping schemes remains a big challenge [2].

To be able to combine the black-box coupling of preCICE with heterogeneous time stepping methods we designed a waveform iteration-based coupling scheme [3]. Additionally, we developed a software to facilitate the coupling of the off-the-shelf finite element solver FEniCS with preCICE – a so-called adapter [4].

In this talk, we present how these two components – the waveform iteration-based coupling scheme and the FEniCS-adapter – are combined to be used in a simulation setup that is close to a real application. This allows us to solve coupled problems with heterogeneous time stepping methods or time-scales in FEniCS. We introduce a test case to assess the accuracy of the whole software stack. With the overall architecture and a scheme for thorough evaluation in place, this marks a starting point for applying the proposed methodology to more complex problems.

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