11d An Analysis of Multi-Physics Coupling Techniques for Large-Scale Applications

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As computational bounds are pushed, application codes are expected to solve more complex physics. One way the community is attempting to achieve this is to couple multiple "single application" codes together to address the more complex simulation. This leads to a variety of design difficulties. The type of coupling, ranging from weakly coupled, to strongly coupled, to a fully coupled monolithic system, can have a significant impact on the performance and reliability of the resulting coupled code. This presentation will compare the performance, accuracy, and efficiency of fundamental coupling techniques including successive substitution, Jacobian-free Newton-Krylov methods, and fully coupled Newton's methods. The choice of convergence criteria and inter-application dependency estimation will also be discuss. Results will be shown for basic prototype problems such as advection-diffusion and an electro-thermal-mechanical MEMS actuator.