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Verification of fluid-structure-interaction algorithms through the method of manufactured solutions for actuator-line applications[1] GANESH VIJAYAKUMAR, MICHAEL SPRAGUE, Natl Renewable Energy Lab — Demonstrating expected convergence rates with spatial- and temporal-grid refinement is the "gold standard" of code and algorithm verification. However, the lack of analytical solutions and generating manufactured solutions presents challenges for verifying codes for complex systems. The application of the method of manufactured solutions (MMS) for verification for coupled multi-physics phenomena like fluid-structure interaction (FSI) has only seen recent investigation. While many FSI algorithms for aeroelastic phenomena have focused on boundary-resolved CFD simulations, the actuator-line representation of the structure is widely used for FSI simulations in wind-energy research. In this work, we demonstrate the verification of an FSI algorithm using MMS for actuator-line CFD simulations with a simplified structural model. We use a manufactured solution for the fluid velocity field and the displacement of the SMD system. We demonstrate the convergence of both the fluid and structural solver to second-order accuracy with grid and time-step refinement.

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