Computational Modeling, Analysis and Simulation of Coupled Multi-physics Problems With Applications to Biological, Bio-inspired and Engineering Systems

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Abstract

Over the last decade, there have been dramatic advances in computational modeling, analysis and simulation techniques to understand fundamental mechanisms underlying multi-physics problems. To model such coupled interactions one must efficiently couple mathematical models with proper kinematics and dynamic coupling conditions. This work will present the results from projects that evolved from multidisciplinary applications of differential equations for multi-physics problems arising in biological, bio-inspired and engineering systems. Specifically, numerical methods including finite element methods for efficient computation of nonlinear interaction for coupled differential equation models that arise from such multi-physics applications will be presented. Some theoretical results that validate the reliability and robustness of the proposed computational methodology will also be presented. We will also discuss how such projects can provide opportunities for students and faculty at all levels to employ transformative research in multidisciplinary areas.

References

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