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Towards a Knowledge Graph for Models and Algorithms in Simulation Science – A Use Case in Amputation Surgery

Friday 18 October 2024 09:00 (1 hour)

Designing an ontology and creating a knowledge graph encompassing scientific computing, simulation science, mathematical modeling and a variety of application domains is a truly challenging task. In this talk, we will first sketch the MaRDI endeavor towards abstracting such an ontology and populating such a knowledge graph. Contributed talks by, e.g., F. Wübbeling, will dive into the details. We then sketch a multi-X forward-inverse simulate-optimise-invert use case, namely the novel limb amputation technique AMI (agonist-antagonist myoneural interface). Here, the quantity of interest is the prestretch of the artificial muscle-tendon link, applied during surgery. This renders the entire setting into a parameter identification problem, and ulti-mately, into an optimisation problem. We use this challenging application to showcase the power of the modeled knowledge, in particular with respect to automatically/iteratively tailoring numerical solution schemes to a given model hierarchy with variable target accuracies, precisions and resources. Based on hypothesized "what-if" questions, we demonstrate tradeoffs and benefits between precision (uncertainty), accuracy (certainty) and simulation budgets (runtime, hardware provisioning).

This is joint work with, in alphabetical order, C. Biedinger, M. Burger, C. Homs Poms, J. Fiedler, F. Huber, D. Iglezakis, H. Kleikamp, T. Klotz, T. Koprucki, R. Lautenschlager, B. Maier, M. Reidelbach, O. Röhrle, A. Shehu, B. Schembera, B. Schmidt, A. Schöbel, M. Schulte, T. Kabelow, F. Wübbeling.

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