OPTIMAL MEMORY-STORAGE AND LOW-RANK STRATEGIES FOR ADVANCED AND DATA-DRIVEN MODELLING IN COMPUTATIONAL MECHANICS

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ABSTRACT

The MiniSymposium aims to bring together multidisciplinary expertise in advanced numerical techniques for managing big data in computational mechanics, including machine learning algorithms and low-rank strategies. Key areas of focus include:

1. **Low-Rank Approximations** in numerical solutions, such as SVD and POD for finite element solvers.
2. **Tensor-Based Methods** for efficient storage and processing of multi-dimensional data, including tensor decomposition and QTT methods.
3. **Reduced-Order Modeling (ROM)** using projection-based and data-driven ROMs in structural dynamics and fluid mechanics.
4. **Machine Learning** applications in computational mechanics, including supervised/unsupervised learning, PINNs, and surrogate modeling.
5. **Big Data and HPC** solutions, with a focus on parallel computing, memory-efficient algorithms, and distributed data storage.
6. **Data-Driven and Physics-Based Models** integrating multi-fidelity and multi-scale modeling approaches with adaptive strategies.
7. **Uncertainty Quantification and Optimization** using probabilistic methods and stochastic reduced-order models.
8. **Real-Time Simulation and Control** involving low-rank methods in FEA for structural health monitoring and control of smart infrastructure.
9. **Data Compression and Efficient Storage** techniques to reduce I/O bottlenecks in HPC and manage simulation data efficiently.

The MS welcomes contributions addressing applications in multi-physics and multi-scale problems, including coupled systems, materials science, geomechanics, and biomechanics, while also embracing a wide range of computational science and engineering applications.