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Exploiting Low-rank Structures for the Solution of PDEs Special Session B1

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Exploiting low-rank structures for the solution of partial differential equations (PDEs) has emerged as a powerful technique in the field of numerical simulation and scientific computing. Many real-world systems exhibit inherent low-dimensional patterns among solution variables, allowing for more efficient computation. Techniques like reduced-order modeling, tensor decomposition, matrix factorizations and certain machine learning methods help uncover and exploit these structures, enabling faster simulations and reduced memory usage. This approach not only accelerates the analysis of physical phenomena but also finds applications in fields such as optimal control, uncertainty quantification and computational design. By efficiently approximating complex PDE solutions with fewer degrees of freedom, low-rank methods facilitate scalable algorithms and offer enhanced interpretability, making them invaluable tools for tackling high-dimensional problems in various scientific and engineering domains.

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