

The **Vienna School of Mathematics (VSM)** is a joint graduate school of the mathematics faculties of the **University of Vienna** and the **TU Wien**. The VSM is devoted to top-level PhD education in all branches of mathematics. It fosters intra- and interdisciplinary scientific cooperation and networking among students and advisors and aims at increasing the international visibility of the Vienna area as a center for mathematics.

The VSM currently announces a PhD position in the area of

Adaptive low-rank approximation for the data-driven exploration and solution of PDEs (University of Vienna, Supervisor: V. Kazeev)

The numerical simulation of PDE models requires discretization, which approximates them in terms of finitely many parameters. In large part, classical numerical analysis and scientific computing are dedicated to the design, analysis and efficient implementation of efficient discretizations. These are developed analytically for specific classes of PDEs or even of PDE data and typically rely on problem-specific techniques of low-dimensional approximation. Modern alternative approaches seek to approximate solutions of PDEs by low-parametric functions from more generic approximation classes that are chosen simple (e.g., piecewise-affine functions) but extremely large so as to allow different types of problems (or data) to be treated in a unified way and with high accuracy. Low-parametric approximation in such classes is achieved adaptively, in the course of computation, by imposing a certain structure, such as that of a deep artificial neural network or of a low-rank tensor decomposition.

This project is focused on the numerical solution of PDEs using the adaptive multilevel approximation by low-rank tensor decompositions, which are generalizations of the standard low-rank matrix approximation to higher dimensions. In particular, the tensor-train decomposition (known as «matrix product states» in computational quantum physics) and the hierarchical Tucker decomposition are of main interest since these allow for the desired level of data compression and admit efficient algorithms based on standard matrix algorithms that realize the compression. Possible PDEs to be considered within the project include the Navier–Stokes and nonlinear Schrödinger equations. The project includes the analytical design, implementation and experimental testing of numerical algorithms, and the interplay of these three aspects is instrumental for the project due to the novelty of its approach.

The position requires: (i) a strong background in numerical mathematics, including linear algebra, numerical linear algebra and numerical methods for ODEs and PDEs, (ii) programming skills and an aptitude for the implementation and experimental exploration of numerical algorithms, (iii) proficiency in English (written and spoken).

The advertised position is associated with the Faculty of Mathematics of the **University of Vienna**. The successful candidate will become a member of the Vienna School of Mathematics and is expected to actively contribute to its activities. The extent of employment is 30 hours per week. The position is planned to start on May 15, 2023.

Application Requirements and Procedure

The candidates must have a master degree (or equivalent) in Mathematics at the moment the PhD position starts. The application documents should contain a letter of motivation; the scientific CV with publications list; higher education certificates/diplomas; and, if available, letter(s) of recommendation. Applications have to be sent via the Job Center of the University of Vienna [under Reference number 14083](#). The deadline for application is **April 21, 2023**.