MAX-PLANCK-INSTITUT
FÜR DYNAMIK KOMPLEXER
TECHNISCHER SYSTEME
MAGDEBURG

CSC Seminar

SPEAKER

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TITLE

Diagonally Addressed Matrices

ABSTRACT

The use of mixed-precision arithmetic showed some sizeable performance improvements for dense linear algebra. Meanwhile, for sparse linear algebra due to memory bandwidth limitations the improvements are much smaller. We suggest a storage scheme for sparse matrices that reduces the memory footprint at no loss of information. This has direct benefits for both classical (one-precision) and mixed-precision algorithms.

Many problems arising in e.g. 2D and 3D FEM simulations only show local coupling between the solution components, i.e. the corresponding matrices have a very low bandwidth (distance from the diagonal) under certain permutations. This suggests to store the indices of the entries in a sparse matrix not absolute but relative to the matrix diagonal, which allows to use a much smaller (integer) data type covering a much smaller range of values. We apply this technique to the Compressed Sparse Row (CSR) format, leading to the Diagonally Addressed CSR (DA-CSR) format. We investigate the benefits of this new storage scheme by means of the matrix vector product (SpMV), which is a basic building block of many iterative algorithms. Based on the positive definite subset of the Suite Sparse Matrix Collection, we observe up to 15% performance uplift of DA-CSR having 16 bit inner indices compared to CSR having all 32 bit indices using IEEE double precision values.

Tuesday, November 22, 2022 at 2 pm
seminar room Prigogine