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Performance Analysis of Effective Symbolic Methods for Solving Band Matrix SLEs

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Systems of linear algebraic equations (SLEs) with heptadiagonal (HD), pentadiagonal (PD) and tridiagonal (TD) coefficient matrices arise in many scientific problems. Three symbolic algorithms for solving SLEs with HD, PD and TD coefficient matrices are considered. The only assumption on the coefficient matrix is nonsingularity. These algorithms are implemented using the GiNaC library of C++ and SymPy library of Python. The choice of mathematical methods and software is crucial for the effectiveness of most of the programs for computer modelling of processes, especially when solving complex problems with a big dimension. Usually, these problems cannot be modelled on ordinary PCs for a reasonable amount of time and this enforces the usage of supercomputers and computer clusters instead. Therefore, the aim of this paper is to investigate the performance characteristics of the considered methods with their two implementations being executed on modern (as of 2018) computer clusters. To that purpose, the experimental setup and the results from the conducted computations on the individual computer systems are presented and discussed.

Keywords: heptadiagonal matrix SLEs, pentadiagonal matrix SLEs, tridiagonal matrix SLEs, symbolic algorithms, symbolic libraries, HPC, performance analysis.

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