Performance Analysis of Effective Symbolic Methods for Solving Band Matrix SLAEs

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Systems of linear algebraic equations (SLAEs) with heptadiagonal (HD), pentadiagonal (PD) and tridiagonal (TD) coefficient matrices arise in many scientific problems. Three symbolic algorithms for solving SLAEs 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 the `SymPy` library of `Python` considering five different classes for data storing altogether.
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 research is to investigate the performance characteristics of the considered methods with their implementations being executed on modern (as of 2018) computer clusters – "HybriLIT" and "Avitohol".
It is shown that "HybriLIT" usually works faster than "Avitohol" which is conditioned by its better processors. The order of growth of all the implementations on both the computer platforms is fixed, one exception to that being the `GiNaC` implementation on "HybriLIT" using variable-size lists. The fastest `GiNaC` implementation turns out to be faster than the fastest `SymPy` one on both the computer clusters.