



Symbolic Algorithm for Solving SLAEs with Heptadiagonal Coefficient Matrices

Milena Veneva^{1,a} and Alexander Ayriyan^{1,b}

¹ Joint Institute for Nuclear Research, Laboratory of Information Technologies, Joliot-Curie 6, 141980 Dubna, Moscow region, Russia

e-mail: ^a milena.p.veneva@gmail.com, ^b ayriyan@jinr.ru

Abstract. This paper presents a symbolic algorithm for solving band matrix systems of linear algebraic equations with heptadiagonal coefficient matrices. The algorithm is given in pseudocode. A theorem which gives the condition for the algorithm to be stable is formulated and proven.

Keywords: systems of linear algebraic equations, heptadiagonal matrix, symbolic algorithm, LU factorization

References

- [1] Kim J.G., Park H.W. *Advanced Simulation Technique for Modeling Multiphase Fluid Flow in Porous Media*. In: Laganá A., Gavrilova M.L., Kumar V., Mun Y., Tan C.J.K., Gervasi O. et al. Computational Science and Its Applications – ICCSA 2004. ICCSA 2004. Lecture Notes in Computer Science, 2004, **3044**. Springer, Berlin, Heidelberg, pp. 1 – 9, [doi:10.1007/978-3-540-24709-8-1](https://doi.org/10.1007/978-3-540-24709-8-1)
- [2] Duran A., Celebi M.S., Piskin S. et al. *Scalability of OpenFOAM for bio-medical flow simulations*. The Journal of Supercomputing, 2015, **71**, pp. 938 – 951, [doi:10.1007/s11227-014-1344-1](https://doi.org/10.1007/s11227-014-1344-1)
- [3] El-Mikkawy, M. *A Generalized symbolic Thomas algorithm*. Applied Mathematics, 2012, **3**, 4, pp. 342 – 345, [doi:10.4236/am.2012.34052](https://doi.org/10.4236/am.2012.34052)
- [4] Higham N. J. *Accuracy and Stability of Numerical Algorithms*. SIAM, 2nd edn, 2002, pp. 174 – 176
- [5] Karawia A. A., Rizvi Q. M. *On solving a general bordered tridiagonal linear system*. International Journal of Mathematical Sciences, 2013, **33**, 2
- [6] Atlan F., El-Mikkawy M. *A new symbolic algorithm for solving general opposite-bordered tridiagonal linear systems*. American Journal of Computational Mathematics, 2015, **5**, pp. 258 – 266, [doi:10.4236/ajcm.2015.53023](https://doi.org/10.4236/ajcm.2015.53023)
- [7] Askar S. S., Karawia A. A. *On solving pentadiagonal linear systems via transformations*. Mathematical Problems in Engineering. Hindawi Publishing Corporation, 2015, **2015**, 9, [doi:10.1155/2015/232456](https://doi.org/10.1155/2015/232456)
- [8] Jia J.-T., Jiang Y.-L. *Symbolic algorithm for solving cyclic penta-diagonal linear systems*. Numerical Algorithms, 2012, **63**, 2, pp. 357 – 367, [doi:10.1007/s11075-012-9626-2](https://doi.org/10.1007/s11075-012-9626-2)
- [9] Veneva M., Ayriyan A. *Performance Analysis of Effective Methods for Solving Band Matrix SLAEs after Parabolic Nonlinear PDEs*. Advanced Computing in Industrial Mathematics, Revised Selected Papers of the 12th Annual Meeting of the Bulgarian Section of SIAM, December 20-22, 2017, Sofia, Bulgaria, Studies in Computational Intelligence, vol. 793, Springer International Publishing (X), pp. 407–419, [arXiv:1804.09666](https://arxiv.org/abs/1804.09666)
- [10] Veneva M., and Ayriyan A. *Performance analysis of effective symbolic methods for solving band matrix SLAEs*. Submitted to European Physics Journal – Web of Conferences (EPJ-WoC)
- [11] Veneva M., Ayriyan A. *Effective Methods for Solving Band SLAEs after Parabolic Nonlinear PDEs*. AYSS-2017, European Physics Journal – Web of Conferences (EPJ-WoC). 2018, **177**, 07004, [arXiv:1710.00428](https://arxiv.org/abs/1710.00428)

- [12] Karawia A. A. *A new algorithm for general cyclic heptadiagonal linear systems using Sherman-Morrisor-Woodbury formula*. ARS Combinatoria, 2013, **108**, pp. 431–443, [arXiv:1011.4580](https://arxiv.org/abs/1011.4580)