Robust Task-Parallel Solution of the Triangular Sylvester Equation

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The Bartels-Stewart algorithm is a standard approach to solving the dense Sylvester equation. It reduces the problem to the solution of the triangular Sylvester equation. The triangular Sylvester equation is solved with a variant of backward substitution. Backward substitution is prone to overflow. Overflow can be avoided by dynamic scaling of the solution matrix. An algorithm which prevents overflow is said to be robust. The standard library LAPACK contains the robust scalar sequential solver dtrsyl. This paper derives a robust, level-3 BLAS-based task-parallel solver. By adding overflow protection, our robust solver closes the gap between problems solvable by LAPACK and problems solvable by existing non-robust task-parallel solvers. We demonstrate that our robust solver achieves a similar performance as non-robust solvers.

Keywords: overflow protection, task parallelism, triangular Sylvester equation, real Schur form.