Parallel Robust Computation of Generalized Eigenvectors of Matrix Pencils

Carl Christian Kjelgaard Mikkelsen, Mirko Myllykoski
Department of Computing Science and HPC2N
Umeå University, Umeå, Sweden
{spock,mirkom}@cs.umu.se

In this paper we consider the problem of computing generalized eigenvectors of a matrix pencil in real Schur form. In exact arithmetic, this problem can be solved using substitution. In practice, substitution is vulnerable to floating-point overflow. The robust solvers xTGEVC in LAPACK prevent overflow by dynamically scaling the eigenvectors. These subroutines are sequential scalar codes which compute the eigenvectors one by one. In this paper we discuss how to derive robust blocked algorithms. The new StarNEig library contains a robust task-parallel solver Zazamoukh which runs on top of StarPU. Our numerical experiments show that Zazamoukh achieves a super-linear speedup compared with DTGEVC for sufficiently large matrices.

Keywords: Generalized eigenvectors, Overflow protection, Task-parallelism.