Communication-efficient parallel Bruhat decomposition

Alexander Tiskin[1]

[1] *University of Warwick, Coventry, UK, A.Tiskin@warwick.ac.uk*

We consider the problem of computing the Bruhat decomposition of a matrix on a parallel computer with p processors. The communication and synchronisation between processors are accounted for according to Valiant's bulk-synchronous parallel (BSP) computation model [?, ?, ?]. Our algorithm obtains the Bruhat decomposition of an $n \times n$ matrix in local computation $O(n^3/p)$ per processor, communication $O(n^2/p^\alpha)$ per processor, and $O(p^\alpha)$ barrier synchronisations, for an arbitrary α, $1/2 \le \alpha \le 2/3$. The algorithm generalises the previously known approaches to generic and generic pairwise Gaussian elimination [?, ?], and matches the communication lower bound $\Omega(n^2/p^{2/3})$ on parallel matrix multiplication [?].

References

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