COAST Tech Report 97-23

AN IMPROVED HYPERCUBE BOUND FOR MULTISEARCHING AND ITS APPLICATIONS

by Mikhail J. Atallah

Center for Education and Research in Information Assurance and Security,
Purdue University, West Lafayette, IN 47909
AN IMPROVED HYPERCUBE BOUND FOR MULTISEARCHING AND ITS APPLICATIONS

MIKHAIL J. ATALLAH
Department of Computer Science, Purdue University
West Lafayette, IN 47907, USA
E-mail: mja@cs.purdue.edu

Received 15 April 1996
Revised 4 April 1997
Communicated by D. T. Lee

ABSTRACT

We give a result that implies an improvement by a factor of $\log \log n$ in the hypercube bounds for the geometric problems of batched planar point location, trapezoidal decomposition, and polygon triangulation. The improvements are achieved through a better solution to the multisearch problem on a hypercube, a parallel search problem where the elements in the data structure $S$ to be searched are totally ordered, but where it is not possible to compare in constant time any two given queries $q$ and $q'$. Whereas the previous best solution to this problem took $O(\log n (\log \log n)^3)$ time on an $n$-processor hypercube, the solution given here takes $O(\log n (\log \log n)^2)$ time on an $n$-processor hypercube. The hypercube model for which we claim our bounds is the standard one, SIMD, with $O(1)$ memory registers per processor, and with one-port communication. Each register can store $O(\log n)$ bits, so that a processor knows its ID.

Keywords: Parallel algorithms, hypercube, multisearching, trapezoidal decomposition, point location, polygon triangulation.