An Efficient Scheduling Algorithm for Irregular Data Redistribution

游坤明,Yi-Lin Tsai
Computer Science & Information Engineering
Computer Science and Informatics
yu@chu.edu.tw

Abstract

Dynamic data redistribution is used to enhance the performance of an algorithm and to achieve data locality in parallel programs on distributed memory multi-computers. Therefore, the data redistribution problem has been extensively studied. Previous results focus on reducing index computational cost, schedule computational cost, and message packing/unpacking cost. However, irregular data redistribution is more flexible than regular data redistribution; it can distribute different sizes of data segments of each processor to those processors according to their own computation capability. High Performance Fortran 2 (HPF-2), the current version of HPF, provides an irregular distribution functionality, such as GEN_BLOCK which addresses some requirements of irregular applications for the distribution of data in an irregular manner and explicit control of load balancing. In this paper, we present a degree-reduction-and-coloring (DRC) algorithm for scheduling HPF2 irregular array redistribution. We devoted to obtain the minimal number of transmission steps as well as to reduce the overall redistribution time. The proposed algorithm intends to reduce the number of maximum transmission messages in the first phase and then applies graph-coloring mechanism to obtain the

final schedule. The proposed method not only avoids node contention, but also shortens the overall redistribution time. To evaluate the performance of DRC algorithm, we have implemented DRC algorithms along with the Divide-and-Conquer algorithm. The simulation results show that DRC algorithm has significant improvement on communication costs compared with the Divide-and-Conquer algorithm.

Keyword : Irregular redistribution, communication scheduling, GEN_BLOCK, degree-reduction