Abstract

This work is in the field of parallel computing and, in particular, in the development and use of computational models in heterogeneous parallel architectures to solve applied problems. We address a number of problems that are related to the application of technology in the field of agricultural engineering. The problems are: landform representation, processing climate information (for example, temperature), and water resources management. The study and the solution of these problems in the geographical area in question may suppose an important economic and environmental impact. The problems are formulated in a mathematical model whose solution is computationally costly, and sometimes the solution in a reasonable time is not possible. Our work deals with the implementation of fast and efficient parallel algorithms to solve the associated mathematical problems in multicore and multi-GPU nodes. In addition, some techniques are proposed, studied and implemented to automatically adapt the routines to the parallel system where they are installed, with the aim of obtaining executions close to the optimum and at a low computational cost. The objective is to provide the users with portable software able to run efficiently on the target computer, regardless of the characteristics of the architecture and the user knowledge of it.

Keywords: High performance computing, parallel computing, autooptimization, heterogeneous parallel architecture, multicore, multi-GPU.