ARCHITECTURE OF AN AUTOMATIC TUNED LINEAR ALGEBRA LIBRARY [1]

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Abstract

The development of automatically tuned software would help to facilitate the efficient utilisation of the routines by non-expert users. Our initial approach to tackle the problem was to identify algorithmic and system parameters of the routines, and to analyse these algorithms both theoretically (with an analytical model) and experimentally in order to determine the influence of the value of the system parameters in the optimum values of the algorithmic parameters.

In [1] an automatically tuned linear algebra library was proposed. This library is composed by a set of linear algebra routines along with their installation routines. During the installation process in a system, the linear algebra routines will be tuned automatically to the system conditions: hardware characteristics and basic libraries used in the linear algebra routines. The values of the algorithmic parameters are obtained automatically at execution time. This methodology was analysed with the LU factorisation.

In [2] the architecture of the proposed library is extended in order to adapts itself to platforms where both the CPU load and the network traffic vary. During the installation process in a system, the linear algebra routines will be tuned automatically to the system static conditions. At execution time the system parameters are adjusted to the current load of the platform and the values of the algorithmic parameters are obtained. This extension of the methodology was analysed with the LU factorisation.

In this work the complete methodology is analysed with several routines: Jacobi methods for the eigenvalue problem, LU factorisation and QR factorisation. Variants for sequential and parallel versions of these routines on a logical rectangular mesh of processors are considered. Analytical models of the different algorithms are developed as the basis of our methodology, and the behaviour of the algorithms are analysed with message-passing using MPI on several platforms: Network of SUN workstations, Network of PCs, SGI Origin 2000 and IBM SP2, and with different basic linear algebra libraries: reference BLAS, machine-specific BLAS and ATLAS.

References

[1] J. Cuenca, D. Gimenez, and J. Gonzalez, "Towards the Design of an Automatically tuned Linear Algebra Library", proceedings of the 10th-Euromicro Workshop on Parallel and Distributed Processing, Gran Canaria Island, Spain, January, 2002, pp 201-208.

[2] J. Cuenca, D. Gimenez, and J. Gonzalez, J.Dongarra, K. Roche, "Automatic Optimisation of Parallel Linear Algebra Routines in Systems with Variable Load", submitted to the 11th-Euromicro Workshop on Parallel and Distributed Processing.

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