

Introduction and Benchmark Test of Parallel FE Structural Analysis System, DIAMOND/IPSAP, as Free Software

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Key Words: *IPSAP, GUI(Graphic User Interface), Parallel Computing*

ABSTRACT

Since late 1970's, high performance computing has been considered to reduce time and efforts. The high performance computing has been used in almost every scientific and engineering field such as bioinformatics, aerospace and automotive engineering. Various supercomputers have been developed and the list of supercomputer can be found in TOP500 Project which was started in 1993 and has announced a list of world fast supercomputers. The fastest computer system listed in 2007 is the BlueGene/L which was developed by IBM. It reached a Linpack benchmark performance of 478.2 TFlop/s. Moreover advancement in CPU architecture is turn to increase the number of core instead of clock speed of CPU due to the heat problems.

For the structural analysis, there have been several efforts to increase the speed in parallel environment such as Salinas Project in US, GeoFEM and Adventure Project in Japan and IPSAP(Internet Parallel Structural Analysis Program)in Korea.

As using Domain-wise Multi-Frontal solver[1], IPSAP shows good performance and accuracy in serial and parallel computing system and has been released by website[2] from 2004. But at that time IPSAP didn't support GUI(Graphic User Interface). Hence the main objective of this paper is the reintroduction of IPSAP with Pre-Post Processor, DIAMOND/IPSAP and the benchmark test to small and big size FE model in serial and parallel computing environment.

The goal of DIAMOND/IPSAP makes it possible that user can apply the geometry and mesh generation procedure of his structure design faster, more easily and more funny. As development environment of DIAMOND/IPSAP, OpenGL-based open source program, Open CASCADE[3] is implemented based on Microsoft Visual Studio 2005.

As a previous step, DIAMOND/IPSAP ver.-1 was developed. DIAMOND/IPSAP ver.-1 support serial and parallel IPSAP analysis on DIAMOND frame and post processing procedure as follows.

First, benchmark test is accomplished with 0.5 MDOF simple wing body model in dual quad-core system. Operating system of computing machine is Windows XP 64bit, CPU

is 2.66GHz and memory size is 16 GHz. Next figure shows test model(left) and parallel speedup result(right). We tested performance test using 1, 2 and 4 cores.

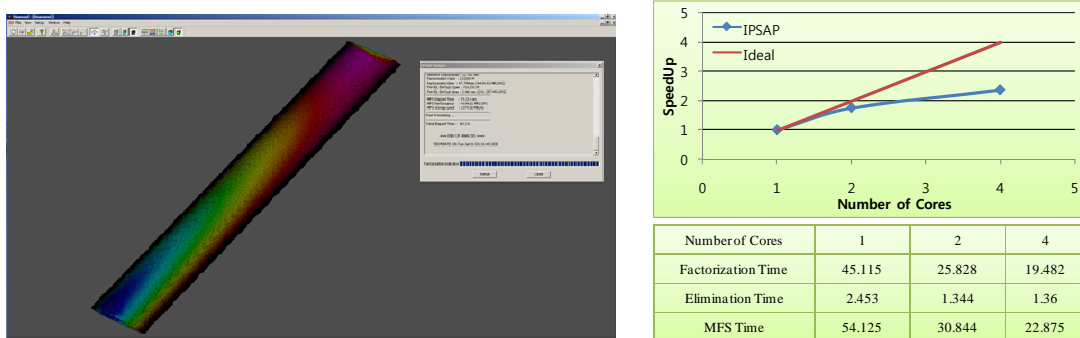


Fig. 1 Test Model and SpeedUp Result

Second, benchmark test is accomplished in a low price notebook system about \$100. Figure 2 represents the specification of notebook. In this computing system, we tested the wing model in Fig. 1. In this benchmark test, we got 104 sec MFS(Multi-Frontal Time) using 1 core processor and 85 sec MFS using 2 cores.

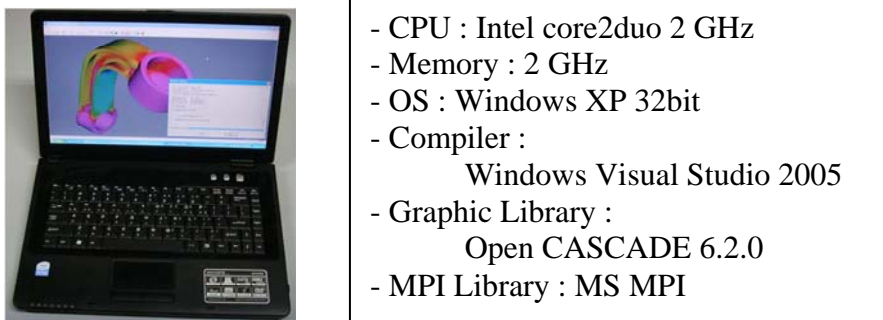


Fig. 2 Low Price Public Notebook

As mentioned above, current version of DIAMOND/IPSAP is supporting analysis and pos processor module. First of all, we will update pre processor module such like geometry and mesh generation. Additionally, by constructing DB(Database), DIAMOND/IPSAP system support a Work-Flow Event Frame and then user can control and manage his design/analysis job widely and easily. And we are trying to apply to the shape optimization of specific engineering problem, for example, satellite. From this, we can set up DIAMOND/SatOpt module.

REFERENCES

- [1] Kim, J.H., Kim, S.J., and Lee, C.S., “High-performance Domain-Wise Parallel Direct Solver for Large-scale Structural Analysis,” AIAA Journal, Vol. 43, No. 3, 2005, pp. 662-670
- [2] <http://www.ipsap.snu.ac.kr>
- [3] <http://www.opencascade.org>