§2. Development of Benchmark Suite for Plasma-Fusion Simulations

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The most famous benchmark program to evaluate performance of supercomputers is LINPACK, and the TOP500[1], which is a large worldwide collection of LINPACK results, is well recognized. The LINPACK is, however, biased to evaluate just the calculation performance and cannot assess overall effective performance of parallel computers as a total system. So the performance score of the LINPACK is far from that is obtained by actually executing the application program. To avoid this detrimental effect of the LINPACK, many attempts to make new benchmark suite, such as HPC Challenge (ICL, US)[2], SSP benchmark (NERSC, US)[3], Teraflop Workbench (HLRS, DE)[4], are going on. But these attempts do not give importance to application programs in the plasma-fusion science and are insufficient for this field.

Considering situations described above, we have started to keep up a new benchmark suite, Performance Analysis Suite for PLasma-fUsion Simulation (PASPLUS, PAS+), which is suitable for plasma-fusion simulations. We choose real-world simulations codes that are parallelized for the shared memory computer using OpenMP or auto parallelization feature and for the distributed memory computer using MPI. The code, which is parallelized by the hybrid model using both OpenMP/auto parallelization feature and MPI, is also included. Our benchmark codes are summarized in Table 1.

We have executed PAS+ on NEC SX-8 (8PE×4, 128GB×4) at National Institute for Fusion Science, NEC SX-8R (8PE×8, 256GB×8) at Cybermedia Center, Osaka University and Hitachi SR11000 (POWER5+, 16core×64, 128GB×8) at Information Technology Center, University of Tokyo, and evaluated parallel performances. As an example, the parallel performances of the impact-3d, which are normalized by the performance of one SX-8 PE, are shown in Fig. 1. From this figure, the impact-3d can be executed on SX-8 12PE as same speed as on POWER5+ 60 cores.

Version history of PAS+ is shown blow.

v1.8(2008/03/04)
- bug fix for fortec3, nsfft3d.
- improvement for make goMAX.
- improvement for skipping unnecessary processes
- add PREEXEC, POSTEXEC, OMPENVTH in config.env.
- add results executed on Hitachi SR11000 at Information Technology Center, University of Tokyo

v1.7(2007/10/12)
- add results executed on NEC SX-8 at National Institute for Fusion Science and NEC SX-8R at Cybermedia Center, Osaka University.

v1.6(2007/09/25)
- reconstruction for result directory.
- add new commands for results handling.
- bug fix for cyl-r1, espic3d, hint2.
- add the logo file.

v1.5(2007/09/03)
- bug fix for nsfft3d, hint2.

v1.4(2007/08/27)
- bug fix for hint2.
- implementation of common report program.
- improvement for config.env.

v1.3(2007/08/21)
- improvement for Makefile and script.

v1.2(2007/08/14)
- bug fix for hint2.

v1.1(2007/07/24)
- bug fix for gkvl.

v1.0(2007/07/18)
- first release.

Table 1. Benchmark codes in PAS+

field	shared memory	distributed memory	hybrid
Hydro/MHD		impact-3d	gkvl
Particle	espic3d	cyl-r1	
Monte Carlo		dcom	fortec3d
MD		md3	
Equili. calc.			hint2
FFT		nsfft3d	

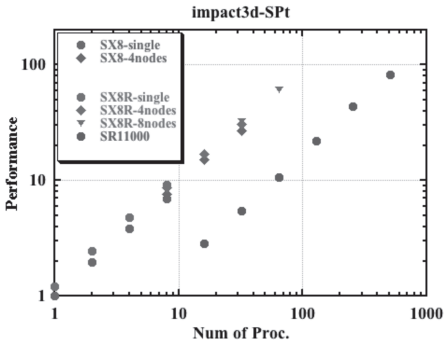

Fig.1. The parallel performances of the impact-3d.

1) http://www.top500.org/.
2) http://icl.cs.utk.edu/hpcc/index.html.
3) http://www.nersc.gov/projects/ssp.php/.
4) http://www.teraflop-workbench.de/.