A Survey of Research Topics:
Towards Challenges and Future Directions of Software Automatic Tuning Technology

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Software automatic tuning is generic information technology, of software, by software and for software. Recently, it is eagerly focused on from "computational science" field of high-performance computing. We keep the situation in perspective from a basis of a "computer science" framework to survey new challenges and future directions of software automatic tuning technology. Application areas, to which software automatic tuning technology can be applicable, are figured out and research issues to be overcome are described. The application includes numerical computation, signal processing, database, web system, real-world computing, bioinformatics and games.

The survey report consists of:
1. Objective and meaning of the investigation,
2. Survey of automatic tuning technology for numerical software,
3. Mathematical model/method for software automatic tuning,
4. Automatic tuning mechanisms and their implementation,
5. Numerical library with automatic tuning features,
6. Target architectures for software automatic tuning,
7. Support tools for software automatic tuning,
8. Application areas to which software automatic tuning is applicable.

We organized a research group of software automatic tuning technology in 2003. Five years has passed since then, we were motivated to make investigation on research topics, which we need to address with reaching an epoch of peta-scale computing. According to planned contents of investigation, the authors are decided to take charge of each chapter, which includes personal views as well as discussion results at the research group meetings. Concerned with topics of each chapter, past research results and unsolved issues are overviewed. The research topics, which should be soon tackled, are discussed and some practical proposals for research funds are roughly shown.

This investigation activity has been carried out from July of 2007 to November of 2008. We very appreciate to the earnest discussions among the members of the research group during the period. Finally we desire that this report will contribute to the progress in software automatic tuning technology.