A Scalable Parallel Eigensolver for Large-scale NVH Problems on Petascale Computing Environment

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ABSTRACT

Large-scale eigenvalue problems arise in wide variety of scientific and engineering applications such as nano-scale materials simulation, vibration analysis of automobiles, analysis of big data, etc. In such situation, high performance parallel eigensolver is strongly required to exploit distributed parallel computational environments. In this talk, we present a parallel eigensolver (SS method, [2]) for large-scale interior eigenvalue problems. This method has a good parallel scalability according to a hierarchical structure of the method. Typically, the method was applied to eigenproblems in large-scale nano simulations on the K-computer, and a remarkable result was obtained [1]. We also present parallel software for computing eigenvalues and corresponding eigenvectors in a given region or interval. This software is designed to incorporate with various applications as an acceleration engine. We illustrate the performance of the software with some numerical examples in large-scale NVH problems of vehicles on peta-scale parallel supercomputers.

REFERENCES

[1] Y. Futamura, T. Sakurai, S. Furuya and J.-I. Iwata, "Efficient algorithm for linear systems arising in solutions of eigenproblems and its application to electronic-structure calculations, *Proc. High Performance Computing for Computational Science - VECPAR 2012*, 226-235, Kobe, (2012).

[2] T. Sakurai and H. Sugiura, "A projection method for generalized eigenvalue problems", *J. Comput. Appl. Math.* **159**, 119-128 (2003).