Effect of matrix data structures in a parallel FE iterative solver using 23,040 cores

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The performance of a parallel iterative solver in a development support middleware for Finite Element Method (FEM), ppOpen-APPL/FEM (ppohFEM), is discussed. The ppohFEM middleware provides application program interfaces (APIs) which is used in FEM calculation. The parallel computational efficiency of the ppohFEM middleware is discussed - when using up to 1440 nodes and 23,040 calculation cores. The time of communication between calculation nodes is less than 1% of total calculation time and the single node performance is essential for the total performance. The performance of the CG solver is compared for the different data structure of the sparse stiffness matrix. When the abstracted data structure is used for the uniform treatment of different degree of freedom for each node, it cause severe performance disadvantage. On the other hand, the BCRS data structure gives the performance which is estimated as upper limit.

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