Parallel Schur Complement type iterations for Collocation linear systems

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We consider the computationally intense problem of solving the large, sparse and non-symmetric system of equations arising from the discretization of Boundary Value Problems (BVPs) by the Collocation finite element method using Hermite bi-cubic elements. As the size of the problem directly suggests the usage of parallel iterative methods, we consider the implementation on distributed memory parallel architectures of a Schur Complement type technique with the Bi-Conjugate Gradient Stabilized (Bi-CGSTAB) iterative method. To induce scalability to our computation, we structure the Collocation matrix to a particular line Red-Black ordered form, leading to the development of well-structured parallel algorithm for the solution method. The realization of the algorithm took place on two different type of grid computers. First on a SUN X2200M2 with 16-nodes and 64 AMD Opteron type cores grid computer connected via an ethernet gigabit network and then on a HP c7000 with 32-nodes and 128 AMD Opteron type cores cluster computer. Speed-up measurements are used to reveal the efficiency of the parallel implementation.