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**ABSTRACT**

**SOLUTION METHODS FOR ON-LINE POWER SYSTEM TRANSIENT STABILITY ANALYSIS**

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Transient stability analysis should be done on-line in terms of real-time power system security and control. In the first part of this study, a parallel-in-space algorithm based on a multi-level partitioning scheme in a distributed memory cluster environment is developed to decrease the wallclock time of transient stability of large scale power systems by using open source software and a small Linux-cluster. LU factorization method is used as a sparse linear solver in this algorithm. The performance of the algorithm is acceptable with the proposed low-cost hardware implementation for large scale power systems. In the second part of the study, the LU factorization method is replaced with Generalized Minimum Residual (GMRES) method in serial solution of the transient stability analysis. Preconditioner is a vital step to accelerate the solution when iterative methods are used instead of direct methods for the solution of linear sets of equations. Our aim is to design a new preconditioner, which is good in both serial and parallel environments. Hence a new preconditioner and a new algorithm for this preconditioner are developed.

**Keywords:** Transient Stability Analysis, Sparse Linear Solver, Parallel Computing

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