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Properties of The Parallel Discrete Event Simulation Algorithms on Small-World Communication Networks

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We discuss synchronization aspects in the method of large-scale simulation, known as parallel discrete event simulation (PDES). We build models of the evolution of simulation time profile in two PDES algorithms, in conservative algorithm and in optimistic one. The models capture the essential properties of the algorithms, namely, the scalability and the degree of desynchronization. We investigate the models on small-world communication networks (SW), which constructed as regular lattices with addition of small fraction of long-range communication links. SW networks are characterized by the small length of average shortest path and by the large value of clustering coefficient. We show that synchronization is better, when processing elements are arranged in SW topology, rather than in regular lattices. In PDES algorithms on SW network the desynchronization remains constant in the limit of infinite number of processing elements, and the same time the average utilization remains positive. We also find, that the degree of clustering in networks has no influence on the synchronization between processing elements, and the synchronization is mainly affected by the length of average shortest path. We present the results of our simulations and compare them with the case-study simulations.

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