The analysis of optimistic parallel discrete event simulation algorithm on small-world networks

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We study synchronization algorithms in parallel discrete event simulations (PDES). We build a model for the evolution of local virtual times (LVT) in the optimistic synchronization algorithm. We run our models on regular and small-world topologies and compare the results. The main parameters of the simulation are the growth rate q and the average fraction of long-range communication links p. We found the power-low dependence of the average speed of the LVT profile on the parameter q. In the model on regular lattice the calculated exponent ν is the same as in directed percolation (DP) universality class, and equals 1.67(3). The exponent ν grows with the average fraction of long-range communication links p. We also calculated another exponent of DP universality class β, which characterizes the behavior of density of local minima and maxima. The calculated exponent β differs from the one in DP universality class. For our model it is β=0.78(4), while for DP it is β_{DP}=0.276486(8). The work is supported by grant 14-21-00158 of the Russian Science Foundation.