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Percolation approach to discharge phenomenon in nonlinear resistor network SHOGO MATSUMOTO, TAKASHI ODAGAKI, Tokyo Denki University — In order to understand the discharge process such as the lightning and streamer discharge, we focus on the percolation of ionized regions which are produced by the local electric field and remote ionization. Exploiting a two dimensional nonlinear resistor network in a square lattice, we investigate discharge when two opposite sides of the lattice are subjected to a constant voltage difference. Each site is assumed to be ionized randomly with probability in proportion to the strength of the electric field, and the resistivity between ionized sites is assumed to be million times smaller than the original resistivity. Using Monte Carlo simulation, we obtain the current and the distribution of clusters of ionized sites as functions of the fraction of ionized sites. The current begins to rise up at a critical point, signifying the transition of non-conductive to conductive state. We find that the critical point for the current is much smaller than the critical percolation probability of the standard site percolation. We also report that singular behavior of the cluster distribution is expected at a critical fraction different from that for the current, and discuss the scaling relation among critical exponents obtained from the current and the cluster distribution.

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