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Effects of finite correlation time and compressibility on the active-to-absorbing-state phase transition: renormalization group approach

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The direct bond percolation process is studied in the presence of random velocity fluctuations. Using Doi approach a coarse grained field-theoretic action is obtained which captures universal
properties of the model near its second order phase transition. Velocity field is modeled by the stochastic Gaussian field with finite correlation time and compressibility taken into account.
The multiplicative renormalizability of the model is proven and the renormalization procedure is then performed to the one-loop order. Stable fixed points of the renormalization group are determined and corresponding regions of stability are calculated within the three-parameter (ε,y,η) expansion.
The model exhibits eight distinct universality classes. Some of them are already well known: the Gaussian (free) fixed point, a directed percolation without advection, and a passive scalar advection. The remaining points correspond to new universality classes, for which an interplay between advection and percolation is relevant.

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