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Some Limit Theorems for a Particle System of Single Point Catalytic Branching Random Walks

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摘要

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Abstract We study the scaling limit for a catalytic branching particle system whose particles perform random walks on ${\Bbb Z}$ and can branch at 0 only. Varying the initial (finite) number of particles, we get for this system different limiting distributions. To be more specific, suppose that initially there are $n^{{\beta}}$ particles and consider the scaled process $Z^n_t(\bullet)=Z_{nt}(\sqrt{n}\, \bullet),$ where Z_t is the measure-valued process representing the original particle system. We prove that Z^n_t converges to 0 when ${\beta}<\frac{1}{4}$ and to a nondegenerate discrete distribution when ${\beta}=\frac{1}{4}$. In addition, if $\frac{1}{4}<{\beta}<\frac{1}{2}$ then $n^{-(2{\beta}-\frac{1}{2})}Z^n_t$ converges to a random limit, while if ${\beta}>\frac{1}{2}$ then $n^{-{\beta}}Z^n_t$ converges to a deterministic limit.

Key words Renewal equation branching particle system scaling limit

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