Large Deviations for a Catalytic Fleming-Viot Type System

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Abstract:

We consider a jump-diffusion process describing a system of diffusing particles that upon contact with an obstacle (catalyst) die and are replaced by an independent offspring with position chosen according to a weighted average of the remaining particles.

The obstacle is a positive function $V(x)$ and the birth/death mechanism is analogous to the one present in the Fleming-Viot critical branching. Both cases $V(x) = \infty \cdot \mathbf{1}_F(x)$, F a closed set (hard catalyst), where typically F is the complement of a domain in $\mathbf{R}^d$, discussed in [2,3], and $V(x)$ bounded (soft catalyst) are considered. Since the mass is conserved, we prove hydrodynamic limits for the empirical measures, described as generalized reaction-diffusion equations, asymptotic behavior of the tagged particles including propagation of chaos under mass-preserving scaling in both the case of soft and hard obstacles (catalysts). In the soft obstacle case we provide a large deviations principle from the deterministic hydrodynamic limit. To obtain a full large deviation principle (see a related model in [4] on the Skorohod space of time-indexed measure-valued paths, an Orlicz-type space is constructed.

The model when independent Brownian particles branch upon hitting the boundary of a smooth domain was introduced in [1] by Burdzy, Hołyst, Ingerman and March (1996). This is in part joint work with **Min Kang** from North Carolina State University.

References

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