

World Scientific Series on  
Probability Theory and  
Its Applications

Volume 5

## Distribution Dependent Stochastic Differential Equations

Corresponding to the link of Itô's stochastic differential equations (SDEs) and linear parabolic equations, distribution dependent SDEs (DDSDs) characterize nonlinear Fokker-Planck equations. This type of SDEs is named after McKean-Vlasov due to the pioneering work of H P McKean (1966), where an expectation dependent SDE is proposed to characterize nonlinear PDEs for Maxwellian gas. Moreover, by using the propagation of chaos for Kac particle systems, weak solutions of DDSDs are constructed as weak limits of mean field particle systems when the number of particles goes to infinity, so that DDSDs are also called mean-field SDEs. To restrict a DDSD in a domain, we consider the reflection boundary by following the line of A V Skorohod (1961).

This book provides a self-contained account on singular SDEs and DDSDs with or without reflection. It covers well-posedness and regularities for singular stochastic differential equations; well-posedness for singular reflected SDEs; well-posedness of singular DDSDs; Harnack inequalities and derivative formulas for singular DDSDs; long time behaviors for DDSDs; DDSDs with reflecting boundary; and killed DDSDs.

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