Hypocoercivity Based Regularity, Sensitivity and Numerical Analyses for Kinetic Equations with Random Uncertainties

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Kinetic equations describe dynamics of probability density distributions of large number of particles, and have classical applications in rarified gas, plasma, nuclear engineering and emerging ones in biological and social sciences. Since they are not first principle equations, rather are usually derived from mean field approximations of Newton's second law, thus contain inevitably uncertainties in collision kernel, scattering coefficients, initial and boundary data, forcing and source terms. In this talk we will review a few recent results for kinetic equations with random uncertainties. We will extend hypocoercivity theory, developed for deterministic kinetic equations, to study local sensitivity, regularity, local time behavior of the solutions in the random space, and also establish corresponding theory for their numerical approximation.