Singular perturbation approximation for the Kuramoto-Sakaguchi integro-differential model

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The Kuramoto-Sakaguchi (or Kuramoto) model was generalized in 1996 so to take into account inertial effects of the nonlinearly coupled random oscillators. The ensuing nonlinear integro-differential partial differential equation is of the Fokker-Planck type, possesses several peculiarities, and was studied in the following years under the restrictive hypothesis that the oscillators frequency distribution had a bounded support. In this paper, such an assumption is relaxed, and existence, uniqueness, and regularity of solution are established.