PRINCIPAL LYAPUNOV EXPONENTS AND PRINCIPAL FLOQUET SPACES OF POSITIVE RANDOM DYNAMICAL SYSTEMS. I. GENERAL THEORY

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Abstract. This series of papers is concerned with principal Lyapunov exponents and principal Floquet subspaces of positive random dynamical systems in ordered Banach spaces. The current part of the series focuses on the development of general theory. First, the notions of generalized principal Floquet subspaces, generalized principal Lyapunov exponents, and generalized exponential separations for general positive random dynamical systems in ordered Banach spaces are introduced, which extend the classical notions of principal Floquet subspaces, principal Lyapunov exponents, and exponential separations for strongly positive deterministic systems in strongly ordered Banach to general positive random dynamical systems in ordered Banach spaces. Under some quite general assumptions, it is then shown that a positive random dynamical system in an ordered Banach space admits a family of generalized principal Floquet subspaces, a generalized principal Lyapunov exponent, and a generalized exponential separation. We will consider in the forthcoming part(s) the applications of the general theory developed in this part to positive random dynamical systems arising from a variety of random mappings and differential equations, including random Leslie matrix models, random cooperative systems of ordinary differential equations, and random parabolic equations.

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