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Lyapunov Functionals and Stability of Stochastic Difference Equations

Leonid Shaikhet

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Hereditary systems (or systems with either delay or after-effects) are widely used to model processes in physics, mechanics, control, economics and biology. An important element in their study is their stability. Stability conditions for difference equations with delay can be obtained using a Lyapunov functional. Lyapunov Functionals and Stability of Stochastic Difference Equations describes a general method of Lyapunov functional construction to investigate the stability of discrete- and continuous-time stochastic Volterra difference equations. The method allows the investigation of the degree to which the stability properties of differential equations are preserved in their difference analogues.
The text is self-contained, beginning with basic definitions and the mathematical fundamentals of Lyapunov functional construction and moving on from particular to general stability results for stochastic difference equations with constant coefficients. Results are then discussed for stochastic difference equations of linear, nonlinear, delayed, discrete and continuous types. Examples are drawn from a variety of physical systems including inverted pendulum control, study of epidemic development, Nicholson’s blowflies equation and predator–prey relationships.
Lyapunov Functionals and Stability of Stochastic Difference Equations is primarily addressed to experts in stability theory but will also be of use in the work of pure and computational mathematicians and researchers using the ideas of optimal control to study economic, mechanical and biological systems.

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