Stability of continuous-time systems with stochastic delay

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We obtain necessary and sufficient conditions for the stability of linear continuous-time systems with stochastically changing delay. It is assumed that the delay can assume values from a finite set of real, positive numbers, it dwells at each value a fixed amount of time, and jumps to a new value according to a stationary probability distribution function. The behavior of the delay allows for constructing a stochastic, linear infinite-dimensional map as an equivalent to the original continuous-time system. By forming the tensor product of this infinite-dimensional map with itself, a proper representation of the second moment is obtained using which stability criteria for the stochastic system are presented. Since, the stability criteria comprise of the spectral radius of infinite-dimensional operators, finite-dimensional approximations are presented that can be used to study the influence of stochastic delay on the stability. Some examples are provided to shed light on the non-predictable effects of the stochastic delay.