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Analytic Solution of Stochastic Fibonacci Equation.

Stochastic Fibonacci equation is a stochastic difference equation with random parameters like the boundary values. These stochastic equations have links with many fields of sciences, including ergodic theory, dynamical systems, heavy-tailed statistics, spectral theory, continued fractions, and condensed matter physics. In this study, we use probabilistic transformation technique (PTT) to solve analytically this equation by find the probability density function (pdf), in closed form, of X_n where the boundary values X_0 and X_1 are random variables with known distributions. PTT technique allows us to calculate the pdf of X_n after algebraic transformation of another random variable like X_0 and X_1 whose pdf, is known. In this study, we solve first the deterministic Fibonacci difference equation, in closed form, in terms of the boundary values then we apply PTT technique to find the pdf of the general solution. The obtained pdf will validated by Monte-Carlo simulation.

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