

# Stochasticity in feedback loops; Great expectations and hard times

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## **Abstract:**

Stochastic feedback systems give rise to a variety of notions of stability: median, mean, and variance stability conditions differ. These conditions can be stated explicitly for scalar discrete-time systems with (almost) arbitrary distributions of the stochastic feedback gain. The state variable in such systems evolves towards a heavy-tailed distribution and exhibits some non-intuitive characteristics. For example, one can use stochastic feedback to stabilise unstable systems where one does not even know the sign of the unstable pole or the sign of the system gain. A more dramatic example is an investment scheme which simultaneously yields unbounded expected profit and almost certain bankruptcy to every investor.