ID de Contribution: **70** Type: **Contributed talk**

# A Stochastic Linear Tracing Procedure to Select a Proper Markov Perfect Equilibrium in Stochastic Games

*jeudi 31 juillet 2025 11:45 (30 minutes)*

The linear tracing procedure plays an essential role in Harsanyi and Selten's (1988) equilibrium selection theory. The concept of proper equilibrium was formulated by Myerson (1978), which is able to eliminate some counterintuitive perfect equilibria in normal-form games. An extension of proper equilibrium to stochastic games leads to a notion of proper Markov perfect equilibrium. To select such an equilibrium, this paper develops a stochastic linear tracing procedure through the constitution of a perturbed stochastic game in which each player in each state maximizes her payoff against a linear convex combination between a prior belief profile and a given mixed stationary strategy profile, where the combination coefficient for each player in each state is a function given by an extra variable to the power of the number of pure actions for the player in each state. Applying the optimality conditions to the integration of the perturbed stochastic game and a convex-quadratic-penalty game, we acquire from the equilibrium condition and transformations on variables a smooth path that starts from an arbitrary Markov strategy profile and ends at a proper Markov perfect equilibrium. As an alternative scheme for the equilibrium selection, we present a stochastic logarithmic tracing procedure to approximate the stochastic linear tracing procedure for selecting a proper Markov perfect equilibrium. Moreover, we give a stochastic linear tracing procedure and a stochastic logarithmic tracing procedure for selecting a perfect d-proper Markov perfect equilibrium, which provides an approximate proper Markov perfect equilibrium but is much less costly to compute.

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**Classification de Session:** Stochastic Programming

**Classification de thématique:** Stochastic Programming