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所属（Domain）　機械システム工学領域（Domain of Mechanical Systems Engineering）

●研究テーマ（Research theme）
① ラウンドアバウトの確率モデル
（A Probabilistic Model for analyzing the Vehicle Flow in a Roundabout）
②分散投資における事後情報の最適利用
（Optimal Use of Posterior Information in Portfolio Construction）
③広帯域ゲイン変動を伴う閉ループのｑｍ安定条件
（qm-Stability of a Closed-Loop with Purely Random Gain）

①ラウンドアバウトの環道を有限個のセルに分割し，各セルに車両が存在する確率の時間発展を記述する差分方程式を導いています．その方程式の定常解は，ある緩やかな条件の下で安定であることが示されます．さらに，流入規則にしたがって運用されているラウンドアバウトは，環道上の車両存在確率が高いときに車両割込み違反の影響を受けやすいことを明らかにしています．

Fig.1.　Cellular representation of a circulatory lane.

The circulatory lane of a roundabout is divided into a finite number of cells and a difference equation is derived in order to describe the time-evolution of the probability that each cell is occupied by a vehicle. The steady state solution of the equation proves stable under a mild condition. In addition, a roundabout under regular operation is shown to be sensitive to the irregular interruption in the casewhere the circulatory lane is crowded.

②効率的ポートフォリオの概念を，データ可測な投資比率と，総収益の条件付平均からの偏差の２乗平均によって評価されるリスクのもとで再述し，これに整合するように定式化された最適化問題を解析的に解くことによって，任意に与えられたリスクレベルのもとで最大の期待収益を達成する効率的ポートフォリオが見出されることを明らかにしています．

The notion of efficient portfolios is re-stated in terms of data-measurable investment rates as well as a modified definition of the risk, in which the risk is evaluated by the unconditional mean of the squared deviation of the total return from its conditional mean. An optimization problem is mathematically solved to find the efficient portfolio that attains maximum expected return with the risk constrained to an arbitrarily given level.

③Stochastic stability is discussed for a closed-loop system composed of a loop transfer function with steep high-cut characteristic and purely random multiplicative gain with unit spectral density. Due to the high-cut characteristic, the Ito integral can be applied in modeling the purely random gain fluctuation for the purpose of stability analysis. The closed-loop is shown to be asymptotically stable in the quadratic mean if and only if the deterministic part of the open-loop transfer function has 2-norm less than unity. This is also a sufficient condition for almost sure asymptotic stability. A simple example illustrates the equivalence between the present result and the former results obtained in different form.
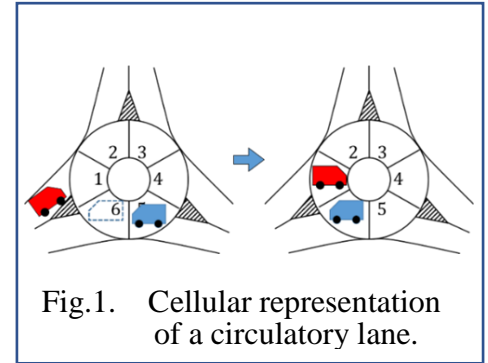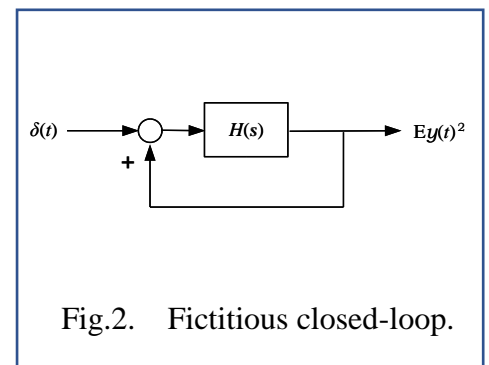

Fig.2.　Fictitious closed-loop.