TARAS SHEVCHENKO NATIONAL UNIVERSITY OF KYIV

INTERNATIONAL CONFERENCE

PROBABILITY, RELIABILITY AND STOCHASTIC OPTIMIZATION

APRIL 7–10, 2015, KYIV, UKRAINE

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National Technical University of Ukraine "Kiev Polytechnical Institute"

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POLYHEDRAL COHERENT RISK MEASURES IN DECISION-MAKING UNDER RISK AND UNCERTAINTY

V. S. Kirilyuk

The mathematical apparatus of polyhedral coherent risk measures (PCRM) introduced for discrete random variables [1] is proposed for the risk assessment. The PCRM class has a number of advantages. It is a subset of the class of coherent risk measures having theoretically attractive properties. Besides, its use allows us to reduce portfolio optimization problems to linear programming problems (LPP) [1].

The PCRM class contains a number of known risk measures. One of the most famous such measures is Conditional Value-at-Risk, which in recent years is seen as a successful replacement for Value-at-Risk. The last one has been widely used in finance and insurance for a long time, but currently it is seriously criticized for a number of shortcomings.

The mathematical tool of PCRM allows constructing such risk measures not only in the conditions of known distributions of random variables, but under incomplete information on the distributions [2]. For example, for case of imprecise scenario probabilities of future events.

The examples of constructing PCRM are considered. Their use allows us to unite problems of stochastic programming and robust optimization within the overall approach. It is shown how linear optimization problems under uncertainty using such measures can be reduced to appropriate LPP.

The application of this apparatus for portfolio optimization problems on risk-reward ratio [3] and maximizing expected utility [4] is discussed. We show how these problems are reduced to LPP not only in the conditions of known distributions of random variables, but under imprecise scenario probabilities. In the latter case it is made for the corresponding robust optimization problems. Reducing the initial decision-making problems to LPP allows us efficiently to solve them even under large dimensions.

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CONVERGES OF OPTIMIZATION PROCEDURE WITH IMPULSIVE PERTURBATIONS

V. R. Kukurba[1], Ya. M. Chabanyuk[2], I. S. Budz[3]

Continuous stochastic optimization procedure (SOP) with semi-Markov's switchings and impulsive perturbations is defined by the evolution equation [1]:

$$du^\varepsilon(t) = a(t)[\nabla_{b(t)} C(u^\varepsilon(t); x(t/\varepsilon^4))dt + \varepsilon d\eta^\varepsilon(t)], \tag{1}$$

where $\nabla_{b(t)} C(u;x) = \frac{(C(u+b(t);x)-C(u-b(t);x))}{2b(t)}$, $u \in R$. The regression function $C(u;x)$ depends on uniformly ergodic semi-Markov process $x(t) > 0, t \geq 0$, in the dimensional space phase of states (X, X), $u^\varepsilon(t), t \geq 0$ is a random evolution, ε is a scheme parameter. Impulsive perturbation process $\eta^\varepsilon(t), t \geq 0$ and its generator are defined in [1].

Consider conditions of existing Lyapunov function $V(u) \in C^4(R)$, that satisfies exponential stability of average system

$$du(t)/dt = C'(u(t)), C(u) := \int_X \pi(dx) C(u;x). \tag{2}$$

Also we defined additional conditions for regression function and use Kramer condition for distribution function to determine conditions of weak converges of SOP (1) for extremum point of average system (2)

$$P\{\lim_{t\to\infty} u^\varepsilon(t) = 0\} = 1.$$

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