

EDITORIAL

Special Issue

Recent Advances in Stochastic Modeling and Its application

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Guest Editor

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When we try to solve a real-world problem, due to the complexity and uncertainty nature of the problem, we first tend to describe it under a stochastic model, based on which we then try to find the solution. Therefore, how to model becomes an important and interesting area of either theoretical or practical research. This special issue of IJOR covers the recent advances in stochastic modeling and its application. The areas of interest include the modeling of logistics and service systems, the theory of queueing and inventory models, risk management and health care.

The opening paper of the issue authored by Ke, Wu and Zhang “Recent Developments in Vacation Queuing Models: A Short Survey” is a well-organized survey paper on vacation models from which there have been deeply investigated sixty-one papers over the past ten years. It intends to provide a brief summary of queueing models with various vacation (server absences) conditions, unfolding possible future directions with stochastic arguments and techniques in this promising area.

The approximation of solutions in a general queueing model has been acquired interminably in many applications since its closed form expression is unattainable by the current techniques. The paper written by Kim “A Queueing Model for an Automated Workstation Receiving Jobs from an Automated Workstation” develops an analytical model for obtaining the average number of jobs, the variance of the number of jobs in queue, and queue size distribution for two automated servers in series. The results are compared with that of previous studies in literature and simulations $G/G/1$, showing better performance of accuracy.

Benneyan, Cullinane, Topcu study the problem of inventory space requirements in remanufacturing facilities over time, considering the variability of recaptured component quality, availability of refurbished components, remanufactured product demand, and returned product rates. Their paper “Stochastic programming recourse models for reconfigurable multi-period storage allocation in remanufacturing facilities” presents multiperiod stochastic programming recourse models developed to identify optimal adaptive schedules for internal, external, and reconfigured storage space requirements in each time period. Results are compared with expected value models, showing computational advantages. In most cases, the solutions with expected value formulations are found to be as much as 34% higher than the stochastic programming recourse solution. The model size and run time of both approaches, however, increase significantly with more periods due to the rapid increase in the number of possible scenarios, variables and constraints.

Risk management is getting more attentions then before in industries, especially, the financial business. For the financial risk management, it is crucial that we are able to estimate the probability of loss, for example,

the loss of the value of a portfolio. Value-at-Risk (VaR) is one of the most widely used indices for analysis and risk management in practice. Since there are many 'risk factors' such as assets in a portfolio, in evaluating VaR the dependence structure between them should be considered. "Dependence Properties of Exit Times with Applications to Risk Management" by Bauerle and Manger considers theoretically the dependence structure of d -dimensional Itô processes and shows a certain kind of positive dependence under some conditions. It also proves that associated processes have associated hitting times. Specializing these results to Ito processes and proving similar statements for time-inhomogeneous processes, some applications in risk management are given for demonstration. "Tail Approximation of Value-at-Risk under Multivariate Regular Variation" by Sun and Li presents a general tail approximation method for evaluating the VaR of any norm of random vectors with multivariate regularly varying distributions. The main result is derived using the relation between the intensity measure of multivariate regular variation and tail dependence function of the underlying copula. The explicit tail approximations for random vectors with Archimedean copulas and multivariate Pareto distributions are also presented to illustrate the results.

Stochastic models in health care have been constructed over a great extent in recent years. Since the needs and applications are often arisen by better management for health care industries, operations research techniques are taking advantages toward the emerging and important area for helping its development. In particular, because liver transplantation and allocation has been a contentious issue in the United States for decades, a good model is called for considering the problem of geographic imbalance between donor supply and patient demand as well as rapid quality decay of livers. The paper "An Efficient Approximation for Refining Organ Geographic Distribution in the U.S. Liver Transplantation and allocation" written by Teng and Kong presents a deterministic sequential matching model to evaluate the impact of allocation region design. It constructs the sequential liver allocation process with incorporation of patient waiting list dynamics, facilitating the analysis of the U.S. liver transplantation and allocation system while giving numerical analysis of liver geographic distribution.

Stochastic modeling is an active research field which stimulates various interactions between theory and practice. IJOR in particular making a special issue has invited submission of papers related to these areas concerned with all aspects, both theoretical and practical, of stochastic models using mathematical arguments where the use of stochastic models is the binding factor of development of Operations Research and their applications. We wish reader may find them interesting and useful for further research and development.

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