Literature Review:

*Altay, N. and Green, W.G. (2006) ‘OR/MS research in disaster operations management’*

Disasters are large intractable problems that test the ability of communities and nations to effectively protect their populations and infrastructure, to reduce both human and property loss, and to rapidly recover. The seeming randomness of impacts and problems and uniqueness of incidents demand dynamic, real-time, effective and cost efficient solutions, thus making the topic very suitable for OR/MS research. While social sciences and humanities literatures enjoy an abundance of articles on disaster management, the OR/MS community is yet to produce a critical mass. In this paper, we survey the literature to identify potential research directions in disaster operations, discuss relevant issues, and provide a starting point for interested researchers.


The main goal of the initial search-and-rescue period after strong earthquakes is to minimize the total number of fatalities. One important difficulty arising in this period is to find the best assignment of available resources to operational areas. For this problem a dynamic optimization model is introduced. The model uses detailed descriptions of the operational areas and of the available resources to calculate the resource performance and efficiency for different tasks related to the response. An adequate solution method for the model is presented as well.
Pulse vaccination is an effective strategy for the elimination of infectious diseases. A delayed epidemic model with pulse vaccination is formulated in this paper. It is proved that the disease-free periodic solution is globally attractive if the vaccination rate is larger than $\theta^*$, and the disease is uniformly persistent if the vaccination rate is less than $\theta^*$. The permanence of the model is investigated analytically. Our results indicate that large vaccination rate or short pulse of vaccination or long latent period is sufficient condition for the extinction of the disease.

Periodic solutions have been found for some infectious disease models of the SI and SEI types. Here four SEI models with either disease-reduced or uniform reproduction are examined to determine the model features that do and do not lead to periodic solutions. The two SEI models with the simple mass action incidence beta XY can have periodic solutions for some parameter values, but the two SEI models with the standard mass action incidence lambda XY/N do not have periodic solutions. For some intermediate values of lambda in the SEI model with incidence lambda XY/N and uniform reproduction, the interior equilibrium is a saddle whose stable manifold separates the attractive regions for the disease-free equilibrium and the susceptible-free equilibrium.

The Author investigate the situation where a customer experiencing an inventory stock out at a retailer potentially leaves the firm’s market. In classical inventory theory, a unit stock out penalty cost has been used as a surrogate to mimic the economic effect of such a departure; in
this study we explicitly represent this aspect of consumer behavior, incorporating the
diminishing effect of the consumers leaving the market upon the stochastic demand
distribution in a time-dynamic context. The initial model considers a single-firm. Author allow
for consumer forgiveness where customers may flow back to the committed purchasing market
from a non-purchasing “latent” market. The per-period decisions include a marketing mix to
attract latent and new consumers to the committed market and the setting of inventory levels.
They establish conditions under which the firm optimally operates a base-stock inventory
policy. The subsequent two models consider a duopoly where the potential market for a firm is
now the committed market of the other firm; each firm decides its own inventory level. In the
first model the only decisions are the stocking decisions and in the second model a firm may
also advertise to attract dissatisfied customers from its competitor’s market. In both cases,
establish conditions for a base-stock equilibrium policy.

Zeynep Müge Avsar and Melike Baykal-Gürsoy (2002) Inventory control under substitutable
demand: A stochastic game application

Substitutable product inventory problem is analyzed using the concepts of stochastic game
theory. It is assumed that there are two substitutable products that are sold by different
retailers and the demand for each product is random. Game theoretic nature of this problem is
the result of substitution between products. Since retailers compete for the substitutable
demand, ordering decision of each retailer depends on the ordering decision of the other
retailer. Under the discounted payoff criterion, this problem is formulated as a two-person
nonzero-sum stochastic game. In the case of linear ordering cost, it is shown that there exists a
Nash equilibrium characterized by a pair of stationary base stock strategies for the infinite
horizon problem. This is the unique Nash equilibrium within the class of stationary base stock
strategies.
In this paper the author address in this paper the mid-term planning of chemical complexes with integration of stochastic inventory management under supply and demand uncertainty. By using the guaranteed service approach to model the time delays in the chemical flows inside the chemical process network, we capture the stochastic nature of the supply and demand variations, and develop an equivalent deterministic optimization model to minimize the total cost including production cost, feedstock purchase cost, cycle inventory and safety stock costs. The model simultaneously determines the optimal purchases of the feedstocks, production levels of the processes, sales of final products and safety stock levels of all the chemicals, as well as the internal demand of the production processes. The model also captures “risk-pooling” effects to allow centralization of inventory management for chemicals that are consumed/produced by multiple processes. We formulate the model as a mixed-integer nonlinear program (MINLP) with a nonconvex objective function and nonconvex constraints. To solve the global optimization problem with modest computational times, we exploit some model properties and develop a tailored branch-and-refine algorithm based on successive piece-wise linear approximation. Five examples are presented to illustrate the application of the models and the performance of the proposed algorithm.

Roberto Rossi, S. Armagan Tarim and Ramesh Bollapragada (2011) Constraint-Based Local Search for Inventory Control Under Stochastic Demand and Lead Time.

In this paper, author address the general multiperiod production/inventory problem with nonstationary stochastic demand and supplier lead time under service-level constraints. A replenishment cycle policy is modeled. We propose two hybrid algorithms that blend constraint programming and local search for computing near-optimal policy parameters. Both algorithms rely on a coordinate descent local search strategy; what differs is the way this strategy interacts
with the constraint programming solver. These two heuristics are first, compared for small instances against an existing optimal solution method. Second, they are tested and compared with each other in terms of solution quality and run time on a set of larger instances that are intractable for the exact approach. Our numerical experiments show the effectiveness of our method.


In this paper the study of multi-server tandem queues with finite buffers and blocking after service is carried out. The service times are generally distributed. Author develop an efficient approximation method to determine performance characteristics such as the throughput and mean sojourn times. The method is based on decomposition into two-station subsystems, the parameters of which are determined by iteration. For the analysis of the subsystems we developed a spectral expansion method. Comparison with simulation shows that the approximation method produces accurate results. So it is useful for the design and analysis of production lines.

Michael Manitz (2008) Queueing-model based analysis of assembly lines with finite buffers and general service times.

In this paper, the author study the production process on multi-stage assembly lines. These production systems comprise simple processing as well as assembly stations. At the latter, workpieces from two or more input stations have to be merged to form a new one for further processing. As the flow of material is asynchronous with stochastic processing times at each station, queueing effects arise as long as buffers provide waiting room. They consider finite buffer capacities and generally distributed processing times. Processing is a service operation to customer items in the sense of a queueing system. The arrival stream of customer items is generated by processing parts at a predecessor station. This paper describes an approximation
procedure for determining the throughput of such an assembly line. Exact solutions are not available in this case. For performance evaluation, a decomposition approach is used. The two-station subsystems are analyzed by $G/G/1/N$ stopped-arrival queueing models. In this heuristic approach, the virtual arrival and service rates, and the squared coefficients of variation of these subsystems are determined. A system of decomposition equations which are solved iteratively is presented. Any solution to this system of equations indicates estimated values for the subsystems’ unknown parameters. The quality of the presented approximation procedure is tested against the results of various simulation experiments.