

Booklet of Abstracts

Stochastic Models: Methods and Applications

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**ΕΙΔΙΚΟΣ ΛΟΓΑΡΙΑΣΜΟΣ
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Detailed Schedule

9:00-9:30

Dieter Claeys, Jan-Pieter Dorsman, Apoorv Saxena, Joris Walraevens and Herwig Bruneel. **A Queueing-theoretic Analysis of the Threshold-based Exhaustive Data-backup Scheduling Policy.**

9:30-10:00

Ekaterina Evdokimova, Sabine Wittevrongel and Dieter Fiems. **A Taylor series approach for coupled queueing systems with intermediate load.**

10:00-10:30

Ioannis Papachristos and Dimitrios G. Pandelis. **On the Optimal Use of a Slow Server in Two-Stage Queueing Systems.**

10:30-11:00

Chiara Ronzoni, Andrea Ferrara and Andrea Grassi. **An Optimization Model For The Costs Allocation In Spare Parts Collaborative Networks.**

11:00-11:30

COFFEE BREAK

11:30-12:00

Tuan Phung-Duc and Velika Dragieva. **Stability Condition for a Multiserver Retrial Queue with Interaction between Servers and Orbit.**

12:00-12:30

Ioannis Dimitriou. **A system with coupled processors and simultaneous arrivals.**

A Queueing-theoretic Analysis of the Threshold-based Exhaustive Data-backup Scheduling Policy

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Abstract. We analyse the threshold-based exhaustive data backup scheduling mechanism by means of a queueing-theoretic approach. Data packets that have not yet been backed up are modelled by customers waiting for service (back-up). We obtain the probability generating function of the system content (backlog size) at random slot boundaries in steady state.

A Taylor Series Approach for Coupled Queueing Systems with Intermediate Load

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Abstract. We focus on the numerical analysis of a coupled queueing system with Poisson arrivals and exponentially distributed service times. Such a system consists of multiple queues served by a single server. Service is synchronised meaning that there is a departure from every queue upon service completion and there is no service whenever one of the queues is empty. It was shown before that the terms in the Maclaurin series expansion of the steady-state distribution of this queueing system when the service rate is sent to 0 (overload) can be calculated efficiently. In the present paper we extend this approach to lower loads. We focus on a sequence of Taylor series expansions of the stationary distribution around increasing service rates. For each series expansion, we use Jacobi iteration to calculate the terms in the series expansion where the initial solution is the approximation found by the preceding series expansion. As the generator matrix of the queueing system at hand is sparse, the numerical complexity of a single Jacobi iteration is $O(NMK)$, where N is the order of the series expansion, K is the number of queues and M is the size of the state space. Having a good initial solution reduces the number of Jacobi iterations considerably, meaning that we can find a sequence of good approximations of the steady state probabilities fast.

On the Optimal Use of a Slow Server in Two-Stage Queueing Systems

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Abstract. We consider two-stage tandem queueing systems with a dedicated server in each queue and a slower flexible server that can attend both queues. We assume Poisson arrivals and exponential service times, and linear holding costs for jobs present in the system. We study the optimal dynamic assignment of servers to jobs assuming that two servers cannot collaborate to work on the same job and preemptions are not allowed. We formulate the problem as a Markov decision process and derive properties of the optimal allocation for the dedicated (fast) servers. Specifically, we show that the one downstream should not idle, and the same is true for the one upstream when holding costs are larger there. The optimal allocation of the slow server is investigated through extensive numerical experiments that lead to conjectures on the structure of the optimal policy.

An Optimization Model For The Costs Allocation In Spare Parts Collaborative Networks

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Abstract. The paper focuses on the aftermarket spare parts in the automotive industry. In particular, only products with infrequent and low quantity demand are considered. This work is an extension of a previous work by the same authors in which a stochastic model for the optimal inventory policy of spare parts has been presented. In this paper the authors improved what has been called “the second layer” in the previous model, that is the products allocation among a collaborative network of distributors. The improvement is related to the basic model and to the introduction of new products in the network.

Stability Condition for a Multiserver Retrial Queue with Interaction between Servers and Orbit

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Abstract. A retrial queue is characterized by the feature that an incoming call that cannot receive service immediately upon arrival joins a virtual waiting room (orbit) and retries for service in a random time. Most of models in the literature assume that the servers only serve incoming calls. Recently, Artalejo and Phung-Duc [1] study two-way communication queueing models where the server makes outgoing calls in its idle time. It is assumed in [1] that outgoing calls are independent of incoming calls in the orbit. In this paper, we relax this assumption by introducing the interaction between the servers and the orbit. In particular, we consider the case where outgoing calls may be those in the orbit. For this extended model, we establish the necessary and sufficient stability condition. It turns out that the stability condition depends on the retrial rate which is a new finding in the queueing literature.

REFERENCES

- [1] J. R. Artalejo and T. Phung-Duc (2012). Markovian retrial queues with two way communication. *Journal of Industrial and Management Optimization*, 8, 781–806.

A system with coupled processors and simultaneous arrivals

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Abstract. In this work, motivated by emerging applications in wireless concurrent access networks and manufacturing, we analyze for the first time a system of two coupled queues accepting three flows of jobs, say a central and two background. A job from the central flow is split in two sub-jobs, which are placed simultaneously at each queue, while each background job joins a dedicated queue. We also assume that the departure rate at each queue, depends on the presence/absence of jobs in the other queue. We investigate stability conditions and prove that the generating function of the joint queue length distribution is obtained as a solution of a Dirichlet boundary value problem. A simple numerical example is also presented.

