Booklet of Abstracts

Stochastic Models: Methods and Applications

SAMMA 2017

September, 29th, Thessaloniki, Greece

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Detailed Schedule

9:00-9:30
Alain Jean-Marie, Eleni Vatamidou, **The Class of Semi-Markov Accumulation Processes.**

9:30-10:00
Sarah Dendievel, Guy Latouche, Yuanyuan Liu, **A Fluid Queue Modulated by a Varying Markovian Environment**

10:00-10:30
Tuan Phung-Duc, Velika Dragieva, **Stability Analysis of Multiserver System with Servers-Orbit Interaction and Feedback.**

10:30-11:00
Maximiliano Udenio, Eleni Vatamidou, Jan C. Fransoo, **A Control Theoretic Analysis Of The Bullwhip Effect Under Triple Exponential Smoothing Forecasts**

11:00-11:30
COFFEE BREAK

11:30-12:00
Nico M. van Dijk, **Bounds and Error Bounds for unsolvable CT Markov Chains**

12:00-12:30
Jens Baetens, Bart Steyaert, Dieter Claeys, Herwig Bruneel, **Delay Analysis of a Variable-Capacity Batch-Server Queue with General Class-Dependent Service Times**

12:30-13:00
Ioannis Dimitriou, Tuan Phung-Duc, **Riemann-Hilbert boundary value problem for single-server systems with two orbits for blocked and feedback customers**

The Class of Semi-Markov Accumulation Processes

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Abstract. In this paper, we introduce a new accumulation process, the Semi-Markov Accumulation Process (SMAP). This class of processes extends the framework of continuous/time Markov Additive Processes (MAPs) by allowing the underlying environmental component to be a semi-Markov process instead of a Markov process. Next, we follow an analytic approach to derive a Master Equation formula of the Renewal type that describes the evolution of SMAPs in time. We show that under exponential holding times, a matrix exponential form analogous to the matrix exponent of a MAP is attained. Finally, we consider an application of our results where closed/form solutions are rather easy to achieve.

A Fluid Queue Modulated by a Varying Markovian Environment

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Abstract. We consider an infinite fluid queue modulated by a Markovian environment which varies slowly between two different modes of behaviour. We derive the series expansion of the stationary density of its buffer content as a function of the aggregated stationary densities of the buffer contents of the two environmental fluid queues.

Stability Analysis of Multiserver System with Servers-Orbit Interaction and Feedback

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Abstract. This paper considers a multiserver loss system with servers-orbit interaction and feedbacks motivated from call centers. Incoming calls that are blocked upon arrival join an orbit from which they independently retry after some random time. In addition, idle servers make outgoing calls to the customers either in the orbit or outside. We assume that incoming calls, outgoing calls from the orbit and outgoing calls from outside follow three distinct exponential distributions. Using a Lyapunov function approach, we derive the necessary and sufficient condition for the stability of the system.

A Control Theoretic Analysis Of The Bullwhip Effect Under Triple Exponential Smoothing Forecasts

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Abstract. In this paper, we study the performance of an Automatic Pipeline, Variable Inventory, Order-Based Production Control System (APVIOBPCS) using linear control theory. In particular, we consider a system with independent adjustments for the inventory and pipeline feedback loops and the use of triple exponential smoothing (the Holt-Winters no-trend, additive seasonality model) as a forecasting strategy. To quantify the performance of the system, we derive the transfer functions of the system and plot the frequency response of the system under a number of different parametrizations.We find that the system using Holt-Winters forecasting (the HW-model) significantly outperforms the system using simple exponential smoothing (the SES model), commonly found in the literature, under certain demand assumptions. However, we find that the HW-model is very sensitive to the demand frequency, while the SES is very robust. Thus, the performance range is substantially narrower for the SES model. Finally, we show that previous insights related to behavioral biases are not affected by the choice of forecasting strategy.

Bounds and Error Bounds for unsolvable CT Markov Chains

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Abstract. An approach is presented to compare two Markov Chains, particularly Continuous-Time Markov Chains (CTMC) such as to model Queueing Networks (QN). Here one may typically think of one CTMC or QN to be a solvable modification (e.g. a product form QN) of the other one, say the original, which is of practical interest but unsolvable. The approach is essentially based upon evaluating performance measures by cumulative reward structures and analytically bounding so-called bias-terms, also known as relative gains or fundamental matrix elements. A general comparison and error bound result will be provided. The approach, referred to as Markov Reward approach, is related to Stochastic Dynamic programming and

- may lead to analytic error bounds for the discrepancy, and
- may still apply while stochastic comparison fails

To motivate and illustrate the approach, the presentation will contain an instructive finite tandem queue example and a practical result for a real-life application of an Operation Theater-Intensive care unit system. Some remaining questions for research will be addressed briefly.

Delay Analysis of a Variable-Capacity Batch-Server Queue with General Class-Dependent Service Times

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Abstract. In manufacturing, a batch server groups multiple customers that require the same type of service based on a specific characteristic, such as temperature or destination. In this paper, we extend previous work with the analysis of the delay in a variable-capacity batch-service queueing system with general class-dependent service times and customer-based correlation in the arrival process. The impact of asymmetry and correlation in the arrival process on the mean delay of a random customer and the tail distribution of the delay is investigated as well.

A Riemann-Hilbert boundary value problem for single-server systems with two queues for blocked and feedback customers

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Abstract. We analyze a novel single-server system with two queues for call-back option and feedback. A Poisson stream of jobs flows into a single-server service system that can hold only one job at a time. If upon arrival the server is busy, the job registers to be called back later by the server. A job that completes its service may request another round of service. Registered jobs and feedback jobs are said to be in two separated queues from which they are called by the server in exponentially distributed times. We investigate stability conditions and prove that the generating function of the joint queue length distribution is obtained as a solution of a homogeneous Riemann-Hilbert boundary value problem.