Stochastic Systems, Control, Optimization, and Applications (Part II)

Invited Session

CoDIT 2026 - July 13-16, 2026 | Bari, Italy

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I. Introduction and Motivation

Taking the great opportunities provided by the IEEE 12th International Conference on Control, Decision, and Information Technologies (Co-DIT 2026), following our success in the IEEE 12th Co-DIT 2025), we propose to organize a Invited session devoted to stochastic systems, control, optimization, and applications. We will bring together researchers from multi-disciplinary communities in control and systems theory, control engineering, applied stochastic processes, financial economics, actuarial sciences, applied mathematics, applied probability, biology, electrical engineering, ecology, and networked science, to review, and to substantially update the most recent progress on systems theory and control. We plan to invite researchers from different areas covering a wide range of areas from theoretically oriented talks to application intensive presentations. A number of colleagues have accepted our invitations.

The motivations for putting together the proposed Invited session stem from facing the significant challenges from new and existing applications in control systems, communication networks, signal processing, queueing systems, production planning, biological systems, ecosystems, financial engineering, large-scale systems involving mean-field interactions, hybrid systems under the influence of random environments, and machine learning and neural network applications to control and systems theory.

II. Coverage of the Invited Session

The proposed talks will reflect some of the most interests in a focused area namely stochastic control. They will touch upon many cutting edge research topics with a wide range of applications. The proposed session will prove to be invaluable to the scientific community. It will contribute to the subsequent development of stochastic systems theory and practice, and will have broader impacts to a wide variety of inter-disciplinary fronts.

III. More Details

The proposed speakers and the titles of their presentations are given below. The abstracts are included in the appendix.

1) Chenggui Yuan
2) Hamidou Tembine
3) Pawel D. Domański
4) Tyrone Duncan
5) Richard De Veaux
6) Bozenna Pasik-Duncan

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Appendix

Speakers, Titles, and Abstracts of the Proposed Talks

- Speaker: Chenggui Yuan (Swansea University, UK)

  Authors: Xinwei Li and Chenggui Yuan (Swansea University, UK)

  Title: Stabilization of distribution dependent neutral SDEs with feedback control based on discrete observation
  Abstract: In this talk, I will present the stability of solutions of distribution dependent neutral SDEs with feedback control based on discrete observation, which includes the asymptotic stability and exponential stability in mean square. Additionally, we will study the stability of the corresponding interacting particle systems.

- Speaker: Hamidou Tembine

  Title: Individual Price of Strategic Myopia in Mean-Field-Type Games

  Authors: Hamidou Tembine and Julian Barreiro-Gomez, Department of Electrical Engineering and Computer Science, School of Engineering, Quebec University in Trois-Rivieres UQTR, Quebec, Canada and Department of Computer and Information Engineering, Khalifa University, Abu Dhabi, UAE

  Abstract: We consider a class of mean-field-type games with a finite number of players. We quantify the exact strategic inefficiency that arises in these games when players derive their feedback strategies using classical Hamilton-Jacobi-Bellman (HJB) system of equations that treat the state and/or action probability law as exogenous, termed to as oblivious strategies, rather than solving the true mean-field-type game. Working in a tractable deterministic setting with non-quadratic power costs, we (i) derive closed-form expressions for the feedback equilibria in both the oblivious (mean-taking) and mean-field-type (mean-accounting) formulations, (ii) compute the associated value functions, and (iii) establish a closed-form, nonnegative expression for the Individual Price

of Oblivion or strategic myopia. Our analysis reveals a structural failure of standard equilibrium concepts in strongly coupled regimes: the cost of obliviousness is not merely an approximation error but a strategic liability that grows unbounded as the mean-field type coupling strength increases.

- Speaker: Pawel D. Domanski

  Authors: Jan Szymczak and Pawel D. Domański, Institute of Control and Computational Engineering, ul. Nowowiejska 15/19, 00-665 Warsaw, Poland,

  Title: Stochastic prediction for heavy-tailed processes using extreme gradient boosting

  Abstract: This research proposes novel solution to important control engineering issue to predict stochastic properties of uncertain systems. Frequently such systems are subject to strange uncertainties with resulting time series subject to frequent outliers. Therefore, any associated predicting approach should efficiently operate with heavy-tailed data. There exist modeling tools that incorporate artificial intelligence methods based on the XGBoostLSS framework in the task of stochastic prediction. The solution proposed in the paper extends known XGBoostLSS methodology with heavy-tailed distributions having four degrees of freedom: α-stable for two-sided data and four-parameter kappa in case of one-sided data and extreme value analysis. Therefore, it allows to effectively model disturbances occurring in different research areas. Proposed approach is validated with process industry and hydrological data.

- Speaker: Tyrone Duncan

  Title: A Girsanov Theorem for Rosenblatt Measures

  Authors: P. Coupek, T. E. Duncan, B. Pasik-Duncan and J. Slavik Math, Charles Univ., Prague, Czech Republic; Math. Univ. Kansas, Lawrence, KS Czech Acad. Sci., Prague, Czech Republic

  Abstract: The question of Radon-Nikodym derivatives has played an important role in problems such as probability, statistics, and a number of other fields that have used stochastic models. Radon-Nikodym derivatives for Brownian motion (Wiener measure) are used in the solution of a wide variety of stochastic and non-stochastic problems. Brownian motion is a Gaussian process with independent increments and is a continuous martingale. These two features exhibit themselves in Radon-Nikodym derivatives for Brownian motion (Wiener measure). A Rosenblatt process is neither a Gaussian process nor a martingale. Since these two properties are typically strongly exploited for Radon-Nikodym derivatives for Wiener measure, some other methods have to be determined to obtain explicit expressions for Radon-Nikodym derivatives for Rosenblatt measures. Since a stochastic calculus is available for Rosenblatt processes it is natural to try to use this calculus to obtain useful descriptions of Radon-Nikodym derivatives for Rosenblatt measures. Some Radon-Nikodym derivatives are given explicitly in this context for a Rosenblatt measure. These results are based on the stochastic calculus for Rosenblatt processes given by three of the authors of this abstract.

- Speaker: Richard De Veaux

  Title: Ethical Concerns in Data Science

  Author: Richard De Veaux, Williams College

  Abstract: As data science becomes increasingly influential in domains such as criminal justice, healthcare, and public policy, the ethical responsibilities of data analysts and statisticians have never been more critical. This talk explores some challenges in maintaining and ensuring ethical analyses through a series of real-world casessuch as the proprietary COMPAS recidivism algorithm and the controversial criminal justice sentencing study. We examine how opaque models, biased or incomplete data, and overconfident interpretations can perpetuate injustice and erode public trust. The talk challenges the assumption that complex algorithms are always superior, highlighting how interpretable models can be equally accurate and far more accountable.
  Drawing on examples where public shaming or flawed analyses have caused lasting harm, the presentation underscores the necessity of transparency, reproducibility, and humility in statistical practice. It concludes with a call to action: data scientists must take responsibility for the pedigree of their data, clearly disclose limitations, and reject black-box solutions when human lives and liberties are at stake. Ethical standards in data science are not peripheralthey are foundational.

- Speaker: Bozenna-Pasik-Duncan

  Title: Challenges and Opportunities in STEM ++ Education of Tomorrow The Power, Beauty, and Excitement of the Interdisciplinary Nature of Stochastic Systems

  Author: Dominique Duncan (IEEE Senior Member), University of Pennsylvania (UPenn) IEEE CSS, IEEE SSIT, IEEE SYSC, IEEE EMBS and Bozenna Pasik-Duncan (IEEE Life Fellow), University of Kansas

  Abstract: This presentation focuses on innovative approaches to integrating research and teaching in STEM++ education, emphasizing how to effectively balance mathematics, science, engineering, and technology. The power, beauty, and excitement of stochastic systems and control are highlighted through their inherently cross-boundary and interdisciplinary nature. Using the human brainone of the most complex stochastic systemsas a central example, we demonstrate how collective and collaborative efforts in research, teaching, and learning can advance both education and discovery.
  A rigorous understanding of randomness in systems is essential for modern scientific investigation. The brain provides a natural platform for integrating STEM disciplines and beyond, illustrating the value of interdisciplinary and

cross-disciplinary research in fostering creativity, innovation, and problem-solving beyond traditional disciplinary boundaries. We illustrate how data analysis, statistical modeling, computational methods, and neuroimaging can be combined to address real-world challenges, such as seizure prediction in epilepsy. Collaborative efforts with the Keck School of Medicine at the University of Southern California had a significant educational impact on students at the University of Kansas, demonstrating the value of academicmedical partnerships.

Modeling noise–such as measurement uncertaintyrequires strong foundations in probability and mathematical statistics. Noise cannot be ignored; in many systems it can either stabilize or destabilize behavior. Consequently, deep understanding of randomness is a critical skill, particularly in the era of artificial intelligence and machine learning. Advances in analytical and numerical methods grounded in stochastic theory have increased relevance across diverse domains including finance, biomedicine, actuarial science, telecommunications, robotics, and autonomous systems. Finally, we emphasize that effective STEM++ education must also address the social implications of technology, ethics, and standards, alongside technical rigor, collaboration, passion, and innovation.

Conclusion

Our sessions bring awareness to the importance of integrating research with learning and teaching, innovations and technology, at every level of students' studies including K-12. We are enthusiastic and passionate about the power, beauty and excitement of interdisciplinary and cross- boundaries nature of stochastic systems and control. We also believe that good understanding of probability and mathematical statistics will help to deal with ethical concerns in data science when AI and ML are used.

SUBMISSION GUIDELINES

Papers must be submitted electronically for peer review through PaperCept by **February 07, 2026:** **http://controls.papercept.net/conferences/scripts/start.pl**. In PaperCept, click on the **CoDIT 2026 link "Submit a Contribution to CoDIT 2026" and follow the steps.**

IMPORTANT: All papers must be written in English and should describe original work. The length of the paper is limited to a maximum of 6 pages (in the standard IEEE conference double column format).

DEADLINES

February 07, 2026: deadline for paper submission

April 30, 2026: notification of acceptance/reject

May 20, 2026: deadline for final paper and registration