Control of Nonlinear Stochastic Systems

Open Invited Track at IFAC World Congress 2020

Proposers: Alberto Mellone * **Giordano Scarciotti** *

* *Department of Electrical and Electronic Engineering, Imperial College London, London, SW7 2AZ, UK (e-mail: {a.mellone18,g.scarciotti}@imperial.ac.uk).*

Abstract: This open invited track is intended to bring together recent developments in the field of stochastic control systems. The goal is to allow active researchers in the area of stochastic control to showcase new advances in terms of both theoretical contributions and applications. Contributions are invited in, but not limited to, the following areas:

- Control of stochastic differential/difference equations;
- Control of stochastic hybrid systems;
- Stochastic optimal control;
- Modelling and analysis of stochastic systems.

1. TECHNICAL COMMITTEE

TC2.3 - Non-linear Control Systems. Additional relevant committees: TC1.4 - Stochastic Systems, TC2.1 - Control Design.

2. A DETAILED DESCRIPTION

The study of stochastic systems is a prolific field of research within the control engineering community. Stochastic systems are modelled as stochastic processes, in that the inputs, the states and the outputs may be subject to random variations. Randomness may be due to system parameters unpredictably varying in time as well as noisy inputs or measurements.

Since Kalman's seminal contribution, see Kalman (1960), modelling and control in the stochastic framework have been developing over the past decades, although a multitude of problems still remain open. The advantage of considering stochastic models of dynamical systems consists in the ability of easily embedding parameter and model uncertainties into the system dynamics. In this way, standard control problems such as robust stabilisation and control can be dealt with by using mathematical results and tools of probability and theory of stochastic processes.

Advancing research in the control of stochastic systems is fundamental, especially since its applications arise in a variety of study fields. Besides classical control engineering problems such as stabilisation, filtering and optimal control, see *e.g.* Krstic and Deng (1998), Yong and Zhou (1999), Øksendal (2003), the stochastic framework is particularly relevant in the context of, *e.g.*, production planning, finance, business and insurance, see Mula et al. (2006), Leland and Toft (1996), Fernholz (2002), Schmidli (2008), Rolski et al. (2009).

We propose an open invited track at the IFAC 2020 World Congress to bring together researchers who are active in the subject of control of stochastic systems. This would give them the opportunity to present their theoretical and applied contributions to the field, to exchange ideas on different topics in stochastic control and to discuss future research directions.

REFERENCES

Fernholz, E.R. (2002). *Stochastic Portfolio Theory*. Applications of Mathematics. Springer.

Kalman, R.E. (1960). A New Approach to Linear Filtering and Prediction Problems. *Journal of Fluids Engineering*, 82(1), 35–45.

Krstic, M. and Deng, H. (1998). *Stabilization of Nonlinear Uncertain Systems*. Communications and Control Engineering. Springer London.

Leland, H.E. and Toft, K.B. (1996). Optimal capital structure, endogenous bankruptcy, and the term structure of credit spreads. *The Journal of Finance*, 51(3), 987–1019.

Mula, J., Poler, R., García-Sabater, J., and Lario, F. (2006). Models for production planning under uncertainty: A review. *International Journal of Production Economics*, 103(1), 271 – 285.

Øksendal, B. (2003). *Stochastic Differential Equations (Sixth Edition)*. Springer-Verlag.

Rolski, T., Schmidli, H., Schmidt, V., and Teugels, J. (2009). *Stochastic Processes for Insurance and Finance*. Wiley Series in Probability and Statistics. Wiley.

Schmidli, H. (2008). *Stochastic Control in Insurance*. Probability and its Applications. Springer-Verlag London.

Yong, J. and Zhou, X.Y. (1999). *Stochastic Controls: Hamiltonian Systems and HJB Equations*. Stochastic Modelling and Applied Probability. Springer New York.