Control Course I: Discrete SISO Controller Design With MATLAB and Simulink

Course Organizer: AuLac Technologies Inc.
Course Instructor: Dr. Ky M. Vu

1 Course Outline

The Control Course I is designed for engineers who want a career in the process control industry. The course discusses discrete SISO controllers that have been used in the process industry and how to design and evaluate them.

1. Day I. Basic System Theory and MATLAB and Simulink

   - MATLAB and Simulink programming.
   - Linear system theory: the steady state model transfer function and the transient state space model. The analysis of a transfer function model: transmission zeros, poles and non-minimum phase systems. The analysis of a transient state space model: the controllability, observability, detectability, stabilizability and reachability of a state vector. Responses to special signals. Signal and system norms. The sensitivity functions. Discretization.
   - Discrete ARIMA time series: moments and spectra.
   - Feedback control system models: tracking and regulating of a disturbed control system.

2. Day II. Discrete SISO Controller Design and Performance

   Designing deterministic tracking controllers.

   - The dead-beat and PID controllers.
   - The Dahlin, Vogel-Edgar, IMC and linear quadratic controllers.
   - The setpoint-model tracking controllers: 1-DOF and 2.5-DOF controllers.

   Designing linear quadratic stochastic controllers.

   - The minimum variance controller.
   - The one-step optimal controller.
   - The N-step optimal controllers.

- The infinite-step optimal controller.

Designing H$_\infty$ controllers.

- With a performance index
- By the small gain theorem

3. Day III. MATLAB and Simulink Project.

An attendee will learn basic commands of The MathWorks Inc.'s products MATLAB/Simulink and finish a project of his (her) choice. The trip to the tulip festival is around lunch time.

- Time and Place: May 10-12, 2017 in a hotel in Ottawa, ON Canada.

- Fee: The fee for the course is US $1,250.00 per attendee. Each attendee will receive the textbook *Optimal Discrete Control Theory: The Rational Function Structure Model* and license to use the software package RTF-SISO Discrete Control Toolbox, a value of US $500.00. The fee includes a trip to the Ottawa Tulip Festival (May 12-22), the largest tulip festival in the world.

- Course CEU credit: 2.1.

2   Attendance

Who should attend? The following professionals should attend: Control, process control engineers, operators, managers as well as control interns who want to consolidate their knowledge in this area.

3   Biography of Instructor

Dr. Ky M. Vu was born in the kingdom AuLac (Vietnam) and educated in Canada. He got his B.A.Sc. at the University of Ottawa, his M.Eng. at McMaster University and his PhD. at the University of British Columbia. He has more than 20 years of experience as a process control engineer in major industries such as petrochemical and pulp and paper. His research interest is in the applications of control, matrix and statistics theories in the real world. His research has earned him respect, friends and recognition throughout the world. He has his name in the AMS (American Mathematical Society) and ResearchGate databases. He has written numerous papers published in prestigious journals such as the IEE Proceedings Control Theory and Applications, International Journal of Control, International Journal of System Sciences, Applied Mathematics and Computation and many control conference proceedings. He is a regularly invited paper reviewer for the Canadian IASTED Control and Applications conferences and the British IET journal in control. He also has published two textbooks "Optimal Discrete Control Theory: The Rational Function Structure Model" (ISBN 978-0-9783996-0-3) and "The ARIMA and VARIMA Time Series: Their Modelings, Analyses and Applications" (ISBN 978-0-9783996-1-0).