Advanced Process Control

(12 – 17 December, 2016)

Department of Chemical Engineering, NIT WARANGAL

1. Overview

The need for high-performance advanced control systems has accelerated over the past decade. Economic pressure, increased environmental and safety concerns and a tighter integration of process units have all contributed towards this demand. The complex nature of manufacturing processes coupled with the large investments in assets by operating companies in the process industries make the need for automated process control greater than ever. At the same time, because of the increased efficiency of process computers, to demand for robust and accurate control of non-linear industrial processes can now be achieved by advanced process control (APC) strategies. APC is a proven technology that reduces process variability and inefficiency, improves product consistency, increases throughput by allowing operations to push constraints to the limits and achieve higher return on assets.Over the years, APC has decisively demonstrated its value as a best practice by increasing throughput and improving yield, energy usage, raw material usage, product quality, safety, and responsiveness.

The current economic crisis, the biggest in almost 100 years, further emphasizes the need for more cost- and resource-efficient production processes. APC is explicitly mentioned in several economic studies as a tool for facing the challenges related to globalization, sustainable development, economic demand, and changing consumer demand. The benefits of using advanced process control strategies include a more consistent product quality, the production of less off-spec material, a significant reduction in energy requirements, making product with less raw materials, increasing the production capacity of existing installations.

The main aim of the proposed course is to develop a quantitative understanding of the various complex techniques that underpin advanced (and modern) process control strategies, and an appreciation of how and when to apply them.

Leading international academics and researchers with extensively recognized expert, and demonstrable ability in teaching, consultancy, research, and training in the field of advanced process control will deliver lectures and discuss industrially relevant case studies in the course.

2. Objectives

On completion of the training, participants will be able to:

i) Understand the main forms of dynamic models, linearization and state-space formulations
ii) Perform the analysis and tuning of advanced single-input single-output (SISO) control strcutures
iii) Understand key concepts of Multi-input multi-output (MIMO) system analysis and multivariate control design
iv) Understand key concepts of state estimation and linear model predictive control design
v) Underrstand the implemenation and design aspects of nonlinear model predicitve control approaches
vi) Perform simulation studies on filtering, model predictive control and nonlinear model predictive control using simulation tools.

Dates	12 – 17 December, 2016
Modules	• Introduction, Role of the models in control. Plant testing for model building. Time series models. • Hands-on execise and interactive tutirial session using the control system analysis toolkit (CSAT) for the dynamic analysis of linear systems. • Analysis and design of SISO and MIMO closed-loop systems • Hands-on exercise and interactive and numerical examples of PID controller tuning. • State estimation: Kalman filtering, Sources of noise and filter formulation. Discrete time Kalman filter design. Riccati equation. Realisation and implementation issues. • Optimal control and Model predictive control. Hands on sessions on Kalman filtering, Extended Kalman filtering and model predictive control.
You Should Attend If…	▪ you are a faculty member/research scientist in chemical /Instrumentation/Control/Electrical/Electronics/relevantengineeringdiscipline interested in modeling, simulation and advanced control. ▪ you are a professional engineer interested or working in optimization and process control in industries. ▪ you are a UG/PG student or research scholarinterested in learning advanced process control concepts.
Fees	The participation fees for taking the course is as follows: **Participants from abroad : US $300** **Industry/ Research Organizations: Rs.10,000/-** **Faculty: Rs. 4,000/-** **Students & Research Scholars:** **Without award of Grade: Rs. 1,000/-** **With award of Grade: Rs. 2,000/-** The above fee includes all instructional materials, computer use for tutorials and assignments and 24hr free internet facility. The participants from academic/research institutes and Industry will be provided with boarding and lodging on additional payment of Rs. 4,500/- in NIT campus on sharing basis. Students & Research Scholars will be provided with boarding and lodging in Institute Hostels on additional payment of Rs. 2,500/-.

The Faculty

	**Prof. Zoltan K Nagy**, Professor, School of Chemical Engineering, Purdue University, USA is the international resource person. He has over 20 years of experience in advanced process control, process analytical technologies and crystallization modelling& control approaches with applications in the pharmaceutical, food and fine chemical industries. His current research focuses on the application of systems approaches & tools in the design & robust control of batch & continuous crystallization systems. He has authored more than 120 archival journal papers and the co-author of 4 books. He graduated 15 PhD students and currently supervises or co-supervises 20 in the UK and Purdue. https://engineering.purdue.edu/ChE/people/ptProfile?id=79574	Course Coordinators
	**Dr. NiketKaisare**, Associate Professor, Department of Chemical Engineering, IIT Madras is the national resource person. He worked about three years in Industrial R&D, with General Motors and ABB Corporate Research. He authored 35 papers in peer-reviewed international journals and is a co-inventor on five patent submissions. He was awarded IIT-M Young Faculty Recognition Award for Research and Teaching in 2010, and INAE Young Engineer Award in 2011. His specific research interest include model-based control, optimisation, multi-scale modelling, combustion in micro-reactors and fuel processing and storage. http://www.che.iitm.ac.in/~nkaisare/members/nkaisare.html	
	Dr. A. Seshagiri Rao is an Associate Professor in the Department of Chemical Engineering at NIT Warangal, India. His research interests include Process control, nonlinear dynamics, time delay systems, model based control, waste water treatment. He is recipient of INAE young engineer award and IIChE young researcher award in 2014. http://www.nitw.ac.in/nitw/div/view.php?facultyid=16460	**Dr. A. Seshagiri Rao** Phone: +91-8332963407 Email: seshagiri@nitw.ac.in
	Dr. G. UdayBhaskarBabu is an Assistant Professor in the Department of Chemical Engineering at NIT Warangal, India. His research interests include energy integration, process modeling and simulation, model predictive control, fractional order controllers, fuel cells. http://www.nitw.ac.in/nitw/div/view.php?facultyid=16422	**Dr. G. UdayBhaskarBabu** Phone: +91-8332969404 E-mail: udaybhaskar@nitw.ac.in