# CHANCE CONSTRAINED PROCESS OPTIMIZATION UNDER UNCERTAINTY

Arellano-Garcia, Harvey and Wozny, Günter
Department of Process Dynamics and Operation, Berlin University of Technology,
Sekr. KWT-9, D-10623 Berlin, Germany,
Fax: +49 (30) 314-21619, E-mail: **arellano-garcia@tu-berlin.de**

## ABSTRACT

Uncertainties may have a large impact on equipment decisions, plant operability, and economic analysis. Thus the consideration of uncertainties in optimization approaches is necessary for robust process design and operation. As a part of it, efficient chance constrained programming has become an important field of research in process systems engineering. In this work, a new approach is proposed for chance constrained programming of large scale nonlinear dynamic systems, in which some dependent variables at certain time points are to be constrained with a predefined probability. This new approach is an extension and a modification of our existing method for nonlinear chance constrained process optimization, which has been utilized for steady state processes. The main idea of this method is the employment of the monotone relation between output constraints and uncertain variables, so that the probabilities and their gradients can be achieved by numerical integration of the probability density function of the multivariate uncertain variables by collocation on finite elements. The new approach involves new efficient algorithms for realizing the required reverse projection and hence the probability and gradient computation with an optimal number of collocation points so that the original idea is now applicable for dynamic optimization problems with larger scale. This approach is applied for optimization problems of a batch distillation with a detailed dynamic process model.

**References**

Arellano-Garcia H., Martini W., Wendt M., Wozny G., Robust Operational Process Design Optimization under Uncertainty, *In: C. A. Floudas, R. Agrarwal (Eds.): Proceedings of FOCAPD 2004.*

Arellano-Garcia H., Martini W., Wendt M., Wozny G., A New Optimization Framework for Dynamic Systems under Uncertainty, *In: A. Barbarosa-Póvoa, H. Matos (Eds.): "European Symposium on Computer Aided Process Engineering -14", Elsevier, 2004.*

Li, P., Arellano-Garcia, H., Wozny, G, Optimal Operation of Distillation Processes under Uncertain Inflows Accumulated in a Feed Tank, *AIChE Journal, (2002), 48(6), 1198-1211.*

Li P., Arellano-Garcia H., Wozny G., Reuter E., Optimization of a Semibatch Distillation Process with Model Validation on the Industrial Site, *Ind. Eng. Chem. Res., 37 (1998), 1341 – 1350.*