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PII: S0098-1354(17)30112-6
DOI: http://dx.doi.org/doi:10.1016/j.compchemeng.2017.03.001
Reference: CACE 5751

To appear in: *Computers and Chemical Engineering*

Received date: 15-12-2016
Revised date: 2-3-2017
Accepted date: 3-3-2017

Please cite this article as: Yannis A. Guzman, Logan R. Matthews, Christodoulos A. Floudas, New *a priori* and *a posteriori* probabilistic bounds for robust counterpart optimization: III. Exact and near-exact *a posteriori* expressions for known probability distributions, <*![CDATA[Computers and Chemical Engineering]]*> (2017), http://dx.doi.org/10.1016/j.compchemeng.2017.03.001

New *a priori* and *a posteriori* probabilistic bounds for robust counterpart optimization: III. Exact and near-exact *a posteriori* expressions for known probability distributions

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Abstract

The performance of robust optimization is closely connected with probabilistic bounds that determine the probability of constraint violation due to uncertain parameter realizations. In Part I of this work, new *a priori* and *a posteriori* probabilistic bounds were developed for cases when robust optimization is applied to uncertain optimization problems with parameters whose probability distributions were unknown. In Part II, the focus shifted to known probability distributions and *a priori* bounds. In this paper, new, tight *a posteriori* expressions are developed for constraints containing parameters with specific known distributions, that is, those attributed normal, uniform, discrete, gamma, chi-squared, Erlang, or exponential distributions. The nature of some of the expressions requires efficient implementations, and new algorithmic methods are discussed which greatly improve applicability. These new expressions are much tighter than existing bounds and greatly reduce the conservatism of robust solutions. The theoretical and algorithmic results of Parts I, II, and III allow for wider usage of robust optimization in process synthesis and operations research applications.

1. Introduction

One source of deviation between mathematical models and real-world performance is the presence of model parameters whose exact values are not yet known or are unable to be statically determined. These uncertain parameters can have drastic, detrimental effects on the objective values and feasibility of

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