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PII: S0305-0483(14)00142-X
DOI: http://dx.doi.org/10.1016/j.omega.2014.11.003
Reference: OME1450

To appear in: *Omega*

Received date: 19 January 2014
Accepted date: 6 November 2014

Cite this article as: Esra Koca, Hande Yaman, M. Selim Aktürk, Stochastic lot sizing problem with controllable processing times, *Omega,* http://dx.doi.org/10.1016/j.omega.2014.11.003

Stochastic Lot Sizing Problem with Controllable Processing Times

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Abstract

In this study, we consider the stochastic capacitated lot sizing problem with controllable processing times where processing times can be reduced in return for extra compression cost. We assume that the compression cost function is a convex function as it may reflect increasing marginal costs of larger reductions and may be more appropriate when the resource life, energy consumption or carbon emission are taken into consideration. We consider this problem under static uncertainty strategy and α service level constraints. We first introduce a nonlinear mixed integer programming formulation of the problem, and use the recent advances in second order cone programming to strengthen it and then solve by a commercial solver. Our computational experiments show that taking the processing times as constant may lead to more costly production plans, and the value of controllable processing times becomes more evident for a stochastic environment with a limited capacity. Moreover, we observe that controllable processing times increase the solution flexibility and provide a better solution in most of the problem instances, although the largest improvements are obtained when setup costs are high and the system has medium sized capacities.

Keywords: Stochastic lot sizing, Controllable processing times, Second order cone programming