World Academy of Science, Engineering and Technology
International Journal of Chemical and Molecular Engineering
Vol:9, No:01, 2015

Easy Way of Optimal Process-Storage Network Design

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Abstract : The purpose of this study is to introduce the analytic solution for determining the optimal capacity (lot-size) of a multiproduct, multistage production and inventory system to meet the finished product demand. Reasonable decision-making about the capacity of processes and storage units is an important subject for industry. The industrial solution for this subject is to use the classical economic lot sizing method, EOQ/EPQ (Economic Order Quantity/Economic Production Quantity) model, incorporated with practical experience. However, the unrealistic material flow assumption of the EOQ/EPQ model is not suitable for chemical plant design with highly interlinked processes and storage units. This study overcomes the limitation of the classical lot sizing method developed on the basis of the single product and single stage assumption. The superstructure of the plant considered consists of a network of serially and/or parallelly interlinked processes and storage units. The processes involve chemical reactions with multiple feedstock materials and multiple products as well as mixing, splitting or transportation of materials. The objective function for optimization is minimizing the total cost composed of setup and inventory holding costs as well as the capital costs of constructing processes and storage units. A novel production and inventory analysis method, PSW (Periodic Square Wave) model, is applied. The advantage of the PSW model comes from the fact that the model provides a set of simple analytic solutions in spite of a realistic description of the material flow between processes and storage units. The resulting simple analytic solution can greatly enhance the proper and quick investment decision for plant design and operation problem confronted in diverse economic situations.

Keywords : analytic solution, optimal design, process-storage network
Conference Title : ICCPE 2015 : International Conference on Chemical and Process Engineering
Conference Location : London, United Kingdom
Conference Dates : January 19-20, 2015