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PARAMETRIC ANALYSIS OF BI-CRITERION SINGLE MACHINE SCHEDULING WITH A LEARNING EFFECT

Pei Chann Chang[1], Shih Hsin Chen[2] and V. Mani[3]

[1]Department of Information Management
Yuan Ze University
135, Yuan-Dong Road, Tao-Yuan, 32026, Taiwan
iepchang@saturn.yzu.edu

[2]Department of Electronic Commerce Management
Nanhua University
32, Chungkeng, Dalin, Chiayi 62248, Taiwan

[3]Department of Aerospace Engineering
Indian Institute of Science
Bangalore 560-012, India

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Abstract. *In a manufacturing system workers are involved in doing the same job or activity repeatedly. Hence, the workers start learning more about the job or activity. Because of the learning, the time to complete the job or activity starts decreasing, which is known as "learning effect." In this paper, we present a parametric analysis of bi-criterion single machine scheduling problem of n jobs with a learning effect. The two objectives considered are the total completion time (TC) and total absolute differences in completion times (TADC). The objective is to find a sequence of jobs that minimizes a linear combination of total completion time and total absolute differences in completion times; i.e.,* $\delta * TC + (1-\delta) * TADC$ *(*$0 \leq \delta \leq 1$*). In an earlier study, this bi-criterion problem with a learning effect is formulated as an assignment problem and the optimal sequence is obtained, for a given value of* δ*. The computational complexity for solving an assignment problem is* $O(n^3)$*. In our study, the learning effect is included in the positional penalties/weights, and hence the simple matching procedure given in an another earlier study is used to obtain the optimal sequence. The complexity of the matching procedure is O(n log n). We show that the optimal sequence, depends on the value of* δ *and the learning index (*α*). In this paper, a parametric analysis of* δ*, for a given learning index (*α*) is presented to show the range of* δ *in which a sequence is optimal. We also present a method of obtaining the set of optimal sequences. A parametric analysis of* α *for a given* δ *is also presented. Numerical examples are presented for ease of understanding the methodology.*

Keywords: Single machine scheduling, Bi-criterion problem, Learning effect, Parametric analysis

1. **Introduction.** During the past fifty years, single machine scheduling problem has been studied by many researchers. A good introduction to sequencing and scheduling is given in [3], and also various issues related to single machine scheduling is presented. In conventional manufacturing systems, the processing time of a job is assumed to be a constant. When the workers are repeating the same job again and again, they start learning about the job. Because of this "learning effect," the processing time of a job is not a constant. This "learning effect" is first presented in [16] and is a well-known concept in management science literature. A survey of the learning effect observed in many practical situations is given in [18].