Level Workforce Schedules for Two-Stage Transfer Lines

Joseph G. Szmerkovsky
Case Western Reserve University

Abstract

Consider a serial transfer line in which each job is processed on each transfer station for \( c \) periods. The number of workers available for each operation of a job is known and it is equal to the number required to complete the operation in precisely \( c \) periods. Jobs transfer synchronously after every production cycle of \( c \) periods. We consider three workforce leveling objectives termed maximin workforce size \( W_{\text{min}} \), minimax workforce size \( W_{\text{max}} \) and range \( R \). The \( W_{\text{min}} \) objective maximizes (over all possible schedules) the smallest workforce size required over the production horizon and the \( W_{\text{max}} \) objective minimizes (over all possible schedules) the largest workforce size required over the production horizon. The range objective produces a schedule for which the difference between the largest and smallest workforce requirement (over the production horizon) is the smallest possible. In this paper we address the problem of leveling the workforce for 2 stations with these objectives. Optimal algorithms that exploit the problems’ relationship with the complementary Hamiltonian cycle problem are provided. These algorithms are used in computational experiments to demonstrate that a 0.7% increase in workforce can protect a transfer assembly line from unnecessary disruptions in the size of the workforce from one day to the next.