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OPTIMAL PROJECT SCHEDULING WITH DISCRETE CAPACITY SHARING

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In [1] the problem of optimal project scheduling was treated under the assumption of continuous capacity sharing. In this paper attention is paid to the case of discrete capacity sharing for which each of few units forming each capacity may be shifted to another operation only at its end or maybe at the ends of fixed time spans. As well as in the previous model [1], the project fulfillment period is separated into a finite number of stages by moments of operations termination (depending on previous capacities sharing) and maybe with fixed time instants (day or shift ends). The state of an arbitrary i-th operation changes from 0 ("not begun"), to 1 ("in performance") and then to 2 ("terminated") due to the logic described in [1]. Capacity sharing conditions are

$$\sum_{i\in I_l, s_i(k)=1} u_i(k) \le R_l, u_i(k) \in \{u_{\min\ i}, \cdots, u_{\max\ i}\},\ l = 1, \cdots, L. \tag{1}$$

The state of the i-th operation progress at the beginning of the k-th stage is denoted by $x_i(k)$. Operations dynamics and passing of time are determined with equations

$$x_i(k+1) = x_i(k) + u_i(k)t(k), \text{ for all } i = 1, \cdots, n \text{ satisfying } s_i(k) = 1; T(k+1) = T(k) + t(k) \tag{2}$$

where $t(k)$ is the k-th stage duration defined from the condition that $T(k+1)$ in (2) is the time of the 1$^{\text{st}}$ event of termination after $T(k)$ of either an operation with $s_i(k)$=1 or the present time span. All feasible transitions for any stage due to (1),(2) form a finite set and so oriented graph G which vertices are states at stage ends and edges are shifts from one state to the next one is finite. For the time of the project fulfilment as the target index the problem of the project optimization is represented as the problem of finding the optimal path on G between the initial and the final state. As for another problem [2], when using the branch-and-bound methods it is necessary to determine only the "promising" fragment of G. For duration of the project as the target index there is a simple lower bound expressed via operations volumes X_i as $T(k) + \sum_{l=1}^{L} (\sum_{i\in I_l} (X_i - x_i(k))/R_l$.

REFERENCES

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