COMPUTER–AIDED WAY TO PROVE THEOREMS IN SCHEDULING MULTIPROCESSOR JOBS [1]

P. Kononova

Sobolev Institte of Mathematics, Novosibirsk, Russia;
Novosibirsk State University, Novosibirsk, Russia
e-mail: polik83@ngs.ru

We consider scheduling problems where processing of each job simultaneously requires a prespecified subset of dedicated machines. This notion is in contrast to the classical scheduling assumption that a job can only be executed on at most one machine at a time. However, a new model correctly describes execution of jobs in modern parallel computer system with shared memory. Scheduling problems with multiprocessor jobs have been considered from the middle of 80th of the last century (see [1]). For more information about these problems, we refer the reader to the survey article by Drozdowski [2].

In [3] Sevastianov and Tchernykh presented a method which allows to obtain some theoretical results for open shop problems with an aid of computer. Particularly, they obtained an upper bound on the length of the shortest schedule in three-machine open shop problem in terms of the trivial lower bound and presented 5/3-approximation algorithm.

In this paper we apply the approach by Sevastianov and Tchernykh for the scheduling problems with multiprocessor jobs. We present a branch-and-bound algorithm which allows for the problems with small number of machines to obtain the following results:
• the algorithm returns tight bounds for the optima localization intervals;
• the algorithm output solutions with provable performance guarantee;
• the algorithm distinguishes non-trivial polynomially solvable classes of instances;
• the algorithm helps to prove NP-hardness.

REFERENCES

1. H. Krawczyk and M. Kubale *An approximation algorithm for diagnostic test scheduling in multiprocessor systems.* — IEEE Transactions on Computing — 1985, V. 34, p. 869–872.
2. M. Drozdowski *Scheduling multiprocessor tasks - An overview.* — European Journal of Operational Research — 1996, Vol. 2, p. 215–230.
3. S. V. Sevastianov I. D. Tchernykh *Computer-Aided Way to Prove Theorems in Scheduling* — Proc. of ESA98 - Lecture Notes in Computer Science, Springer, Germany — 1998, V. 1461, p. 502–513.

[1]The author is supported by the Russian Fond of Humanity (project 13-02-10002)