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Elimination of Waiting Time in Serial Addressless Computer

by

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In connection with the organization of a serial addressless digital computer based on ideas described in [1] and [2] the following problem arises: how to choose the length of the elementary formula, in order to reduce as much as possible the waiting time necessary for transfer of the elementary formula from the serial drum memory (composite formulae memory) to the working memory, assuming that the working memory is realized as one recirculating register on the drum (the terminology is the same as in [2]). Such a solution of a working memory seems to have some advantages in small computers, in which high speed of computation is not very important.

Let us denote
n — the length of the path in the drum,
k — the length of the working memory,
T — work time of the computer.

By the length of the memory we understand the number of words contained in it. The total waiting time T_w in computation of the whole composite formula contained in the path of a drum will be

$$T_w = (nT + kT + kT(k/2))\, n/k,$$

where
nT is the maximum waiting time for the computed elementary formula,
kT — the load time of the elementary formula from the drum to the working memory,
$kT(k/2)$ — the maximum waiting time in computation of the elementary formula stored in the working memory (we assume that with k words $k/2$ dyadic arithmetical operations are associated),
n/k is the number of elementary formulae stored in one path of the drum.

The total waiting time will be minimum if $k = \sqrt{2n}$.

For example, if $n = 64$, $k = 12$ approximately, and the waiting time is reduced three times as compared with the computer without working memory.

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REFERENCES

[1] Z. Pawlak, *On the application of the rule of substitution in the organization of an address-free computer*, Bull. Acad. Polon. Sci., Sér. sci. techn., **8** (1960), 681.

[2] — , *Realization of the rule of substitution in addressless digital computer*, ibid., **9** (1961), 531.