Algorithm to Find and Minimize Logic Function with T-Bloc

R. Berezowski, M. Rajewska, O. Maslennikow

One of the most important elements in electronic systems is to optimize circuits by occupied space or speed. The basics element of this optimization is to reduce the complexity of digital electronic gate circuits (logic function). For many years there was developed various methods for minimizing logic function: mathematical, using de Morgans low, Karnaugh map (K-map) or Veitch diagram using special diagrams which facilitates the search of minterms (in K-map this minterm always had a rectangular area and consisted of 2n fields), then computer: Quine-McCluskey or Espresso (heuristic logic minimizer). The main task of this method was to search minterms and choose the lowest coverage. In the next years, developed a simplified gate XOR and new methods optimization allowed to search and create circuits with such blocks. For example, a one-bit full adder consists two functions: one XOR function (to realize sum of product), the second function call carry-out (this is the so-called majority function). Our team proposes to use all of this functions: traditional minterms, additional XOR block and new T-Block (only for tree arguments its known as majority function but not in general case). This paper present easy way to find T-Blocks and also present general algorithms for minimize logic functions with T-Blocks. This paper also present an implementation of T-Block in current-mode digital gates technology. Current-mode CMOS digital gates technique is being developed since the end of nineties of the last century, in Technical University of Gdansk, and next in Technical University of Koszalin. In this technique logical levels correspond to the specific values of the current on the gate input, therefore in the general case current-mode gates algebra is multivalued algebra with the radix N 2. Such technology radically increases the systems (for example cryptographic) level of immunity to PAA attacks and to attacks by the analysis of electromagnetic field changes. Moreover, current-mode technology operate in multivalued logic, which among other things allows to radically decrease the width of the data bus in the system.