TEMPERATURES INFLUENCE OF NANOCIRCUITS

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The operation of logical nanocircuits on cellular quantum-dots automatas is based on the use of majority elements, one of the options is shown in Fig. 1. The work of the majority element is based on the principle of selecting the majority of binary signals from an odd number of inputs. The signal that is applied to most inputs will be output. Applying them, you can implement the logical functions AND and OR . If a logical zero is applied to one of the inputs, which is called programmable, then you can use the other two inputs to implement the logical AND function. If you apply a logical unit to the programmable input, then an OR element is obtained. Any of the inputs of the majority element can be used as programmable [1,2]

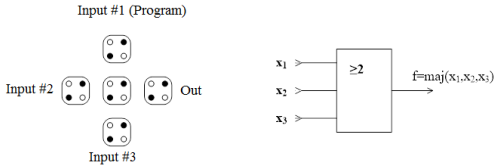


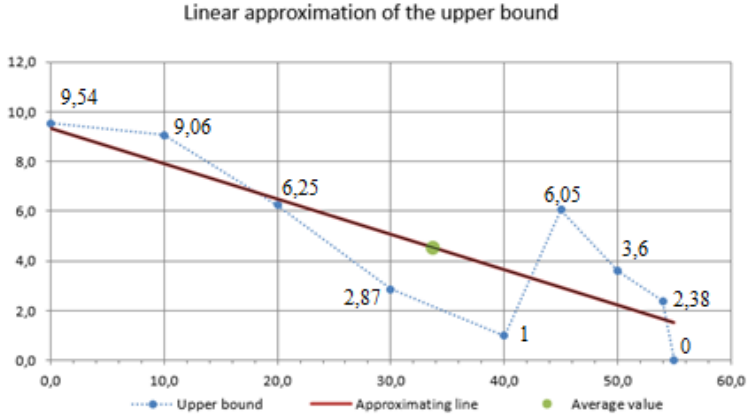
Figure 1: Nancircuits of the element of majority choice (2 out of 3) based on cellular automatas (a) and its symbol (b)

The QCADesigner computer-aided design system was used for research the dependence of Out (T) in the unprogrammed majority element. Changing the simulation settings (Changing the value of T in the range from 0 to 54.5K) were obtained data on the operation of the majority element at different temperatures, data after each simulation of the dependence were recorded in the table (Table 1).

T	Upper bound	Lower bound
0	9,54	-9,54
10	9,06	-9,06
20	6,25	-6,25
30	2,87	-2,87
40	1	-8,17
45	6,05	-4,5
50	3,6	-2,71
54	2,38	-1,91
54,5	0	0

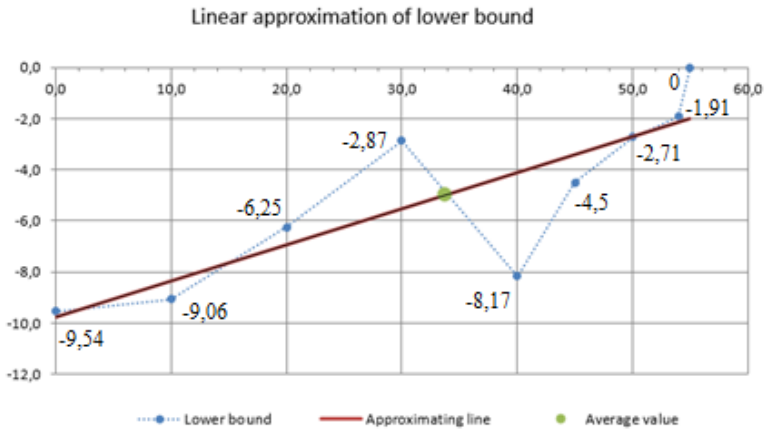
Table #1. Output versus temperature table

Using the Ordinary Least Squares method (linear function y=a*x+b), the resulting graphs were approximated and we get the following:



Lineal aproximation of upper bound: y=-0,1420x+9,3234

a)



Lineal aproximation of lower bound: y=0,1410x-9,7621

b)

Figure: 2. Resulting gpaphs of output versus temperature with using the Ordinary Least Squares method: a – Upper bound, b – Lower bound

Reference

1. Tougav P. D. Logic Devices Implementated using Quantum Cellular Automata. // Journal Applied Physics. 1994, #3, p.p. 49-53.

2. Melnik O. S. Myshynsky A. V. Cipher Nanodevices. // Proc. of the XV Int. Conf. "Electronics and Applied Physics." T. Shevchenko National University of Kyiv. 22-26.10.2019, p.p. 41-43.