Abstract

This article is based on the application of heuristic algorithms to minimize the average power consumption in a VLSI circuit. The idea is to find the optimum layout and temperature for a 3 stage ring oscillator with minimal dynamic average power. The objective function is the same as average power ($P_{avg}$) of 3 stage ring oscillator with 6 CMOS inverters that depends on the temperature and the two different group of channel widths for NMOSs and PMOSs ($W_1=W_3=W_5$ and $W_2=W_4=W_6$). These parameters make a three dimensional search space which is explored by search agents of algorithms. Motivated by the convergence of Modified Shuffled Frog Leaping Algorithm (MSFLA), Genetic Algorithm (GA) and the link of MATLAB with HSPICE Software the minimized average power of 3 stage ring oscillator is obtained. Based on MSFLA, Fuzzy-MSFLA, GA, and Fuzzy-GA algorithms the best resulting for $P_{avg}$ in 0.18µm Technology and the supply voltage of 5v is 1.19 µW based on Fuzzy-MSFLA.

References

- Michaelsen, J. A. 2012. Tutorial notes about “Ring Oscillators”, INF4420 course material at the Department of Informatics, University of Oslo, Norway.
Minimization of Average Power Consumption in 3 Stage CMOS Ring Oscillator based on MSFLA, Fuzzy-MSFLA, GA, and Fuzzy-GA

Yao, Y. Z. 2006. "Comparative Study of Low Phase Noise Voltage Controlled Oscillator (VCOs) in CMOS Technology". M. Sc., Concordia University, Montreal, Quebec, Canada.


Khaliji, M. 2014. &quot;Theoretical and Practical training of Shuffled Frog Leaping Algorithm, SFLA&quot; , Researcher in Control Engineering, University of Tabriz, Iran, The training source of Artificial Intelligence in Iran; Tutorial website of www.matlabsite.com

Docking, S. 2002. &quot;Oscillation Frequency of a Ring Oscillator&quot; A thesis of Master of Science, Electrical and Computer Engineering, University of Waterloo.


Huynh, T. H. 2008, April 2008. &quot;A modified shuffled frog leaping algorithm for optimal tuning of multivariable PID controllers.&quot; In Industrial Technology, , IEEE
International Conference on (pp. 1-6). IEEE.

Index Terms
Computer Science Fuzzy Systems

Keywords
3 stage CMOS ring oscillator minimal average power optimum layout and temperature Fuzzy-MSFLA
MSFLAF
GA
and Fuzzy-GA.