TITLE: Design and Analysis of Fibonacci Charge Pump

STUDENT NAME: R J PRAVIN ARUN

COLLEGE NAME: Sri Eshwar College of Engineering

Problem Statement:

In modern low-power systems, generating higher voltages from a low supply is critical for applications such as display drivers, EEPROM/Flash memories, and RF circuits. Traditional Dickson charge pumps suffer from threshold voltage losses, reduced efficiency, and larger silicon area. The Fibonacci charge pump, using a Fibonacci-like topology of capacitors and switches, offers improved voltage gain and reduced parasitic effects. The main challenge is optimizing this design for higher efficiency and compact implementation in tools like eSim.

Abstract:

Charge pump circuits are widely used for on-chip voltage generation in integrated circuits and energy harvesting systems. Among the various topologies, the Fibonacci charge pump provides an effective way to achieve high voltage multiplication with fewer stages compared to the Dickson charge pump. This work presents the design, simulation, and analysis of a four-stage Fibonacci charge pump. The circuit is designed using Schottky diodes and capacitors, simulated in eSim, and evaluated for output voltage gain, efficiency, and load regulation. The Fibonacci topology achieves higher voltage boosting per stage by following the Fibonacci sequence connection of capacitors, thereby reducing the number of stages required for a desired output. Simulation results confirm that the proposed design can deliver improved performance for low-voltage energy harvesting and embedded system applications. This approach demonstrates the Fibonacci charge pump as a viable alternative for compact, low-cost, and energy-efficient voltage multipliers.

Proposed Circuit:

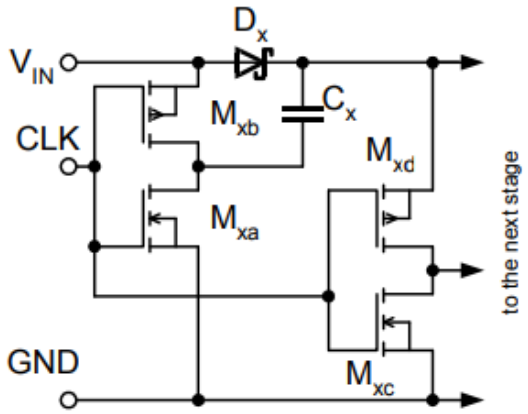

Figure 1. The one stage of the original FCP structure [6].

References:

1. David Matoušek, Jiří Hospodka, Ondřej Šubrt, *New Discrete Fibonacci Charge Pump Design, Evaluation and Measurement*, Measurement Science Review, Vol. 17, No. 3, 2017.
2. Younis Allasasmeh, Stefano Gregori, *A Performance Comparison of Dickson and Fibonacci Charge Pumps*, IEEE, 2009.