

Research Master Project

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• **Project 1: Study of the Memristor Device Models**

Candidate: Mouna Hamdaoui

The concept of a memristor was originally envisioned in 1971 by circuit theorist Leon Chua as a missing non-linear passive two-terminal electrical component relating electric charge and magnetic flux linkage. According to the governing mathematical relations, the resistance of a memristor is not constant but depends on the history of current that had previously flowed through the device, i.e., its present resistance depends on how much electric charge has flowed through it and in which direction in the past. The device remembers its history. When the electric power supply is turned off, the memristor maintains its most recent resistance state until it is turned on again.

In this work, the student is asked to cover a proper amount of information about the history, introduction, implementation, modeling and applications of the memristor device. However, the main focus of this master research work is on memristor modeling.

Tasks

- Study of the history of the basic circuit elements (resistor, inductor, capacitor), and then discusses where the memristor was originated from.
- Study of the memristor device (clear definitions and discussing of its properties)

- Literature review about the more popular memristor models that are available and its application and Make a comparison among them to identify the most suitable model for memory application as an example.
- Study of the different materials used in memristor fabrication, the manufacturing techniques and several physical structures. (Is there any matching with the studied models)
- Simulate the more suitable models and compare result. (for the simulation the student will use Cadence, Hspice, MATLAB, VerilogA)

Reference:

- [1].L. Chua, "Memristor-The missing circuit element," IEEE Transactions on Circuit Theory, vol. 18, no. 5, pp. 507– 519, 1971.
- [2].Ascoli, Alon, et al. "Memristor model comparison." IEEE Circuits and Systems Magazine 13.2 (2013): 89-105.