

Towards a Memristor Model Library in Modelica

Kristin Majetta¹ Christoph Clauss¹ Torsten Schmidt²

¹ Fraunhofer Institute for Integrated Circuits IIS, Design Automation
Division EAS Dresden

Zeunerstrasse 38, D-01069 Dresden, GERMANY

² Technische Universität Dresden, Faculty of Electrical and Computer
Engineering

Helmholtzstrasse 18, D-01062 Dresden, GERMANY

{kristin.majetta, christoph.clauss}@eas.iis.fraunhofer.de

Torsten.Schmidt1@tu-dresden.de

The memristor (memory resistor) is a special kind of resistor with memory. It was predicted as the missing fourth circuit element by Chua [1] in 1971. Figure 1 shows the proposed graphical symbol.

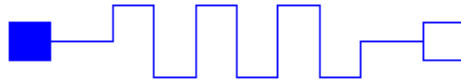


Figure 1 Proposed graphical symbol of the memristor

The advantage of memristors (or more general of memristive devices) is to store information without any power source to be needed. The interests in the memristor rose rapidly when in 2008 Williams from the HP laboratories presented a fabricated memristor [2]. Since then an intensive investigation started on both how a memristor works and how it can be utilized in electronic circuits. This paper deals with the adaption of two published memristor models to Modelica. The first one is called HP-model because it models the fabricated HP memristor. The memristance is built as two variable resistors connected in series. Two extensions, so called window functions, are presented to cover special effects in the HP model that occur in real memristor devices. The second model presented, can be better adapted to given memristor characteristics, e.g. measured data.

To verify the models different voltages were applied, a single voltage pulse, a sinusoidal voltage and multiple voltage pulses. Inasmuch as simulation results were given in the corresponding papers, our results were compared to them. Furthermore a Graetz rectifier circuit which uses memristors instead of diodes and its simulation results are presented.

The modeled memristors are the first step towards the general aim of a library for memristors, and memristive systems. By using the electrical connectors of the MSL the models can easily be applied into multi domain simulations.

References

- [1] Chua, L. O.: Memristor – the missing circuit element. IEEE Trans. Circuit Theory vol. 18, no. 5, pp. 507-519, 1971.
- [2] Strukow, D.; Snider, D.; Stewart, D.; Williams, R.: The missing memristor found. Nature, vol. 453, pp. 80-83, Mai 2008.