Live Demonstration: A TiO_2 ReRAM parameter extraction method

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***Abstract*—We demonstrate a desktop platform which has the ability of modeling ReRAM *TiO_2* samples in a highly automated manner. The system consists of a bespoke RRAM characterization instrument that hosts packaged RRAM devices and is operated via a PC. The system's python-based software includes a module that automatically applies strategically chosen sequences of pulses to a test device and then extracts the suitable parameter values for a resistive switching model from the elicited response.**

I. Introduction

Exploiting the versatility and richness of memristor dynamics to its full potential requires robust ReRAM models for computer-aided design (CAD). Nevertheless, extensive testing of similar ReRAM devices has revealed large variability which probably will not be totally eliminated soon. A practical approach is the simplification of the modeling procedure. This enables the design of an automatic memristor model extraction module which is integrated in current physical device characterization instrumentation.

In [1] we presented a TiO_2 model that captures resistive switching rate dR/dt on bias voltage and initial resistive state (R, v) by using 4 parameters per applied voltage polarity. In the concurrent work [2] we demonstrate a simple parameter extraction algorithm for physical samples, that extracts the suitable values for these parameters by analyzing the data exported by simple experimental testing. This algorithm is now integrated in the characterization platform previously described in [3], which enables direct access to individual devices and obtains characterization results at a click of a button. Specifically, we use the system-available Python interface to a) program the appropriate experimental routine, b) apply the testing on the device and c) analyze the exported data to fit the device [2] on the switching model expressions [1].

II. Demonstration Setup

The demo setup consists of a PCB hosting the platform described in [3] and packaged TiO_2 samples. The PCB is USB-connected with a PC where the corresponding Python interface is run (Fig. 1(a)).

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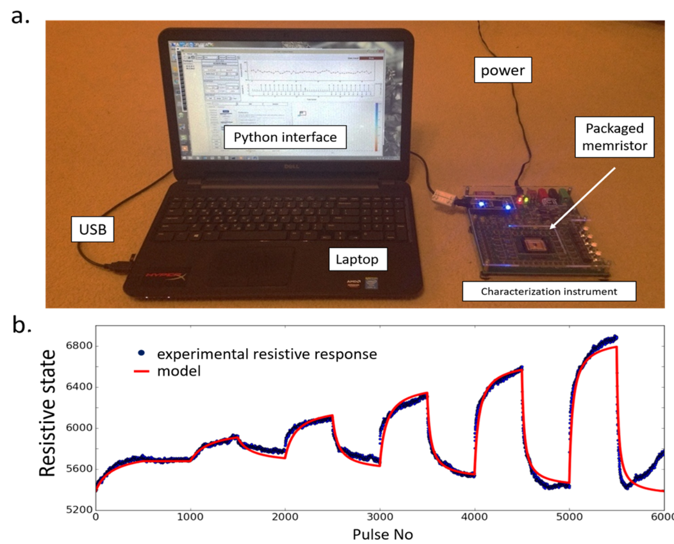

Fig. 1. (a) Demonstration setup: The PCB hosting a packaged TiO_2 sample is USB – connected with a laptop running the Python interface. (b) Measured (blue points) vs simulated (red line) resistive responses responding to stimulation similar to the one shown in Figs. 2 and 3 in [2].

III. Visitor Experience

During the demonstration, the visitor will witness the device characterization procedure and the fully automatic manner in which the suitable parameter values for the tested device are derived. While stimulated, the device under test traverses its resistive range of operation in both directions responding to invasive voltage pulsing of various voltage levels in both polarities. The model is validated by comparing plots of the actual and simulated resistive responses to the characterization routine (Fig. 1(b)).

References

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[3] R. Berdan, A. Serb, A. Khiat, A. Regoutz, C. Papavassiliou, and T. Prodromakis, "A u-Controller-Based System for Interfacing Selectorless RRAM Crossbar Arrays," *IEEE Trans. Electron Devices*, 2015.