Non-Linear Drift Modeling with Controllable ∏-Shaped Window Function for TiO_2 Memristor

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The first memristor realized in 2008 as a physical circuit element were firstly introduced by Chua as a memory-resistor in 1971 [1-2]. Memristor are candidates for many applications, with the properties such as fast switching, low energy requirements, memory ability. Proper modeling of the memristor for analysis of memristive systems is very important. One of the methods used in the modeling of memristor is the nonlinear drift model. In this model, various window functions are used to provide non-linearity [3-5].

In this study, we present a new window function model for memristor modeling. Here, the boundary condition effect for the nonlinear drift model was analyzed considering the speed and acceleration of the boundary between the doped and undoped layers. Depending on the increase or decrease of the acceleration, different dynamic processes can be mentioned in the change of this boundary position along the whole memristor that consists of two regions.

With the four control parameters that the proposed window function has, distributions with different shapes can be obtained. This variety allows for the generation of appropriately shaped window functions for different dynamic processes. At this point, a significant advantage of this window function is that it can be used for different memristor structures made from different materials since the shape is controllable. In addition, the applicability of this model has also been demonstrated by applying parameter estimates for the characterization of memristor structures produced from TiO_2 in laboratory environment.

Keywords: Memristor, Modelling, Non-linear Model, Window Function.

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