Ratio-based Multi-Level Resistive Memory Cells

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Abstract:

In this talk, we will present the concept and mechnisim of ratio-based encoding for resistive memory cells, in which the resistance ratio of a pair of resistance-switching devices, rather than the resistance of a single device (i.e. resistance-based encoding), is used for encoding the information, which significantly reduces the bit error probability. Applicable to both single-level and multi-level memory cells, we demonstrate the advantages of the ratio-based encoding over the resistance-based encoding for designing robust resistive memory systems. We experimentally validated the findings on multiple resistance-switching devices and show that, compared to the resistance-based encoding on the same resistive devices, the proposed approach achieves up to 3 orders of magnitude lower bit error probability, or alternatively it could reduce the cell's programming time and programming energy by 5–10X , while achieving the same bit error probability.

Photo

Short Bio:

K.-T. Tim Cheng received his Ph.D. in EECS from the University of California, Berkeley in 1988. He has been serving as Dean of Engineering and Chair Professor of ECE and CSE at Hong Kong University of Science and Technology (HKUST) since May 2016. He worked at Bell Laboratories from 1988 to 1993 and joined the faculty at Univ. of California, Santa Barbara in 1993 where he was the founding director of UCSB's Computer Engineering Program (1999-2002), Chair of the ECE Department (2005-2008) and Associate Vice Chancellor for Research (2013-2016). His current research interests include hardware verification and security, design automation for flexible hybrid circuits, photonics IC, memristive memories, mobile embedded systems, and mobile computer vision. He has published 500+ technical papers, co-authored five books, advised 50+ PhD theses, and held 12 U.S. Patents in these areas.

Cheng, an IEEE fellow and a fellow of Hong Kong Academy of Engineering Sciences a, received 10+ Best Paper Awards from various IEEE and ACM conferences and journals. He has also received UCSB College of Engineering Outstanding Teaching Faculty Award, Pan Wen Yuan Outstanding Research Award, 2020, and Fellow of School of Engineering, The University of Tokyo. He served as Editor-in-Chief of IEEE Design and Test of Computers and was a board member of IEEE Council of Electronic Design Automation's Board of Governors and IEEE Computer Society's Publication Board.