Research Experience for Community College Students: Design and Optimization of Non-Volatile Latch using Resistive Memory Technology (Anti-fuse & Magnetic Tunnel Junction)

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Abstract

Research experience is enriching and inspiring for undergraduate students. Early exposure to research experience is very effective in building interest and improving retention for students in STEM fields. Given the often-lengthy background preparation needed for conduct of research, it is difficult to incorporate research experience as a curricular activity in regular semesters when students have a lot of distractions managing various assignments in different courses. To address this challenge, we have developed summer research opportunities for community college students. Summer is a time when students have less distractions and can be effectively engaged in a focused research activity. The research internship is planned over 10 weeks of summer, and the student interns are assigned a graduate student mentor and a faculty advisor. This paper presents the details of this project, research and educational objectives, results obtained, and the student surveys assessing the outcomes. The planned research project is related to anti-fuse memory technology, which is a promising one-time programmable nano-scale technology for information storage. In this technology, the information is stored in a resistive form which is a state of a fuse element that is non-volatile and also much more scalable as compared to the existing charge-based storage technologies such as SRAM, DRAM, and flash. In this research, we propose a unique application for anti-fuse memory technology and that is to realize non-volatile single-bit latch element that can be used for building reconfigurable logic circuits. The results of student surveys on the experience of student participants with the research internship strongly suggest that such an experience is very valuable in encouraging students to purse STEM research careers. Moreover, this experience enhances students' technical research skills such as scientific thinking, ability to analyze and interpret results, and presentation skills. This flipped approach to educational pathways in which research experience is offered early on results in students to be more determined and motivated as they progress through their educational pathways.