

Memcomputing: Leveraging memory and physics

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Just like Turing machines are not the only model of computing, digital Von Neumann architecture is not the only computing system available to us (e.g. quantum computers, liquid-state, analog, etc.) Here we discuss a novel computing system architecture built from memristors (memory resistors), a basic electronics component with variable resistance, theorized about in 1971 and used recently for a variety of applications, most notably fast non-volatile RAM. The papers we are presenting discuss digital memcomputing machines (DMM), which are non-general-purpose computing systems for solving some (non-optimization) NP problems efficiently. Another recent paper presents the theory of a universal memcomputing machine (UMM), which the authors claim is a Turing-complete, general purpose computing model. One major advantage of these systems over quantum computers is the reuse of existing electronic circuitry versus specialized hardware. A simulation of their technology is conducted and results are presented showing increasing instance sizes of the Subset-Sum problem solved in polynomial ($O(n^4)$) time. These papers DO NOT offer any formal proofs of $P=NP$, or make any such claims, but rather present computing systems for certain NP problems. The authors have also formed the company, MemComputing, Inc., and together with technology partners are attempting to build such systems.