The Matrix Model of Computation

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Abstract

The Matrix Model of Computation (MMC) is a new Turing-complete virtual machine that serves as a formal container for the structural representation and analysis of systems, and can be applied in diverse areas such as Business, Software Engineering, Theoretical Physics, and Neuroscience. The MMC is a unifying notion in Systemics. It allows uniform, interoperable techniques to be applied to systems in general, using a uniform, machine – interpretable representation that is amenable to formal mathematical manipulation.

In this paper we show the MMC equivalence with Deutsch's Universal Quantum Computer, argue that every finitely realizable physical system can be perfectly represented by an MMC model, and propose the MMC as a Universal Model of Computation. We introduce the canonical form of the MMC and present two Scope Constriction algorithms for module clustering. The algorithms refactor the model to reconcile the flow of data with the flow of control and create objects by partitioning the MMC model into highly cohesive, weakly coupled modules. Finally, we propose an MMC-centric system environment where the MMC serves as a formal tool for system analysis, and recommend an interdisciplinary effort to create it. In an accompanying paper, we present small examples in the areas of business, physics, UML models, and OO analysis, design, and refactoring.

Keywords: semantic web, mathematical model of computation, relational model of computation, refactoring, object oriented, ontology, tools.