

On Building Multidimensional Workflow Models for Complex Systems Modelling

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Abstract. In this research, we proposed a multidimensional workflow model called *Robustness Diagram with Loop and Time controls*(RDLT) to support effective modelling of complex systems. This proposed model is an extension of Robustness Diagram of the Unified Modelling Language. Multidimensionality, in the context of this research, refers to the integration of all three workflow dimensions into one model, i.e. in RDLTs, to provide a modelling framework which can represent systems with a multi-input, multi-output, and multi-activity specification. A substructure called *reset-bound subsystem* is also introduced in the construction of this extension to support the design and use of volatile substructures and behavior in models. Algorithms are proposed to enable an effective activity extraction from these RDLTs. Model properties used for model analysis and verification are defined and proved for RDLTs. These properties are inspired from existing definitions of model properties of other workflows models. For the meantime, we show model properties of node reachability, deadlock-freeness, maximal compositionality of activity profiles, and soundness that are developed for RDLTs. The time and space complexities of activity extraction and model verification are also presented. Finally, we show an instance of complex systems being modelled using RDLTs and illustrate how the proposed algorithms extract an activity from the model.