

## ABSTRACT

### A PROCESS-ORIENTED SYSTEM DESIGN METHODOLOGY WITH GENETIC ALGORITHM SEARCH AND SIMULATION-BASED EVALUATION

by

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Production and business systems are key building blocks in the structure of modern industrial societies. Because of this, improving the performance of production and business systems has been the primary interest of economists, scientists, and engineers. Real-world business and production systems in general consist of thousands of processes. Any system performance is, therefore, a function of the performance of its underlying processes. Such processes are usually complex, nonlinear, stochastic, multi-variant, highly dynamic, with large solution domain.

This research recognizes the problem of designing complex real world production and business systems through optimizing the design of system processes. Toward this end, a process-oriented system design architecture and an associated application software are developed by integrating the following elements:

1. The Process-oriented Design Approach.
2. Process Parametric Optimization with Genetic Algorithm (GA).
3. Process simulation Modeling (SM) with Discrete Event Simulation (DES)

The contributions of this research can be summarized as follows:

1. A highly flexible integration of GA search and simulation-based evaluation has been achieved in the GA-SM architecture.
2. The GA-SM architecture provides the capability of multi-criteria optimization based on three approaches, Process-based Conversion Modeling, Linear Tradeoff, and Interactive Pareto-based.
3. The GM-SM architecture handles the stochastic variability in simulation outputs as an integral part of the optimization process through the Risk Management Evaluation (RME) and the Group Evaluation (GE) approaches.
4. Implementing the GA-SM architecture in a flexible, efficient and interactive software tool has been achieved in the GA-SM Optimizer.