

# MATLAB/Simulink as a Framework for Meta-Model based Evaluation of System variants

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Modeling and simulation with integrated parameter optimization is used routinely to improve system performance. In engineering a well-known environment for this task is MATLAB/Simulink. Using this or similar, established techniques only model parameter values are optimized. Model structure is considered to be fixed. Until now no methods are known which can optimize systems utilizing all degrees of freedom. As system performance is optimized it may be necessary to redesign the model structure. This is carried out manually by an analyst but not automatically by the optimization. The suboptimal combination of automatic parameter optimization and manual structure changes leads to an error-prone optimization task.

The System Entity Structure/Model Base framework (SES/MB) is able to define alternative model structures and parameter sets in a single meta-model. Atomic models are stored in a MB. Using both, it is possible to generate modular, hierarchical models with different structures and parameters.

Evolutionary Algorithms are a subtopic of Artificial Intelligence that is involved in combinatorial optimization problems. These algorithms are based on ideas inspired by biological evolution. They often perform well for many problem types because they do not make assumptions about the problem specific search space.

The research reported in this paper details an approach providing optimization through automatic reconfiguration of both: model structure and model parameters. An evolutionary algorithm based optimization method is assisted by an SES/MB based model management. It searches for an optimal solution with repeated, combined model parameter and model structure changes resulting in a combined parameter and structure optimized model.