

Design space exploration and swarm intelligence

Design Space Exploration (DSE) is a method for finding different system designs at design or even at runtime, which satisfies given structural and numerical constraints. From constraint satisfactory designs it searches for an optimal or nearly optimal solution.

Model-driven rule-based DSE operates on graph structure. It starts from a given model and evolves every iteration with use of graph transformations, till it reaches one or more constraint satisfying states. One of the advantages of DSE is the given list of transformations (trajectory) at the end of a successful run to reach a goal.

Graph transformations rules consist of two main parts, a graph pattern and an operation. Graph pattern defines locations of applicable transformations, through finding pattern-equal parts of the graph, while transformation rules determine

possible operations of these graph parts, using previously given schemas. Model-driven rule-based DSE can solve multi-objective optimization for complex problems. Best solution of these problems is often non-trivial because we have more objectives.

These objectives could be contradicting to each other. E.g. Optimization of safety and cost are often conflicting, if we want to improve safety costs is increased. Swarm-intelligence is an effective heuristic method, for finding a good solution in reasonable time. It is a simulation of successful nature employed survival strategies, such as moving of ants, bees, birds while they are looking for food sources. A common feature between swarm-intelligent methods is the simplicity of participating units. Such a swarm-intelligent based search method is the bees algorithm, which simulates the food collection process of bees. Though one bee alone is ineffective, together they are more successful.