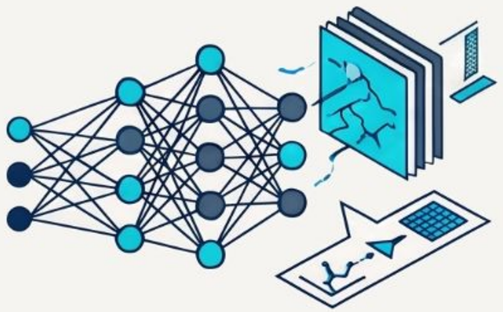
www.dx-dt.at e.u.

Thomas Paier
thomas.paier@dx-dt.at
+43 660 5271777

SARMOO: Robust Multi-Objective Optimization in Engineering Design

SARMOO (Surrogate-Assisted Adaptive Robust Multi-Objective Optimization) solves the problem of computationally intensive Finite Element Analyses (FEA). Through AI surrogate models and a stepwise parameter expansion (Para+), innovative designs are generated that are not only high-performing but also insensitive to manufacturing tolerances.

Generative Multi-Objective Optimization



- **AI surrogate models replace FEA**
  Neural networks (ANN, CNN, ConvLSTM) approximate FEA results and drastically reduce simulation time.



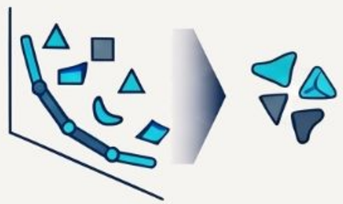
- **The Para+ Method**
  An adaptive mapping sequentially expands design parameters to efficiently explore complex, manufacturable geometries.



- **Pareto Optimization (e.g. NSGA-II)**
  Simultaneous optimization of competing objectives such as maximum stress, manufacturability, and mechanical stability.

Robustness & Final Selection

- **From MOO-NDS to Robust-NDS**

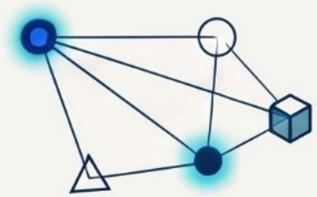


The robustness analysis is deliberately applied only to the final Pareto set to minimize computational effort.

- **Sensitivity to imperfections**

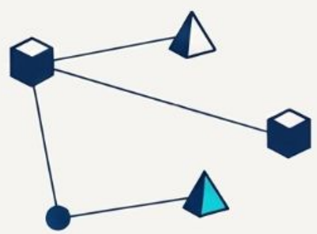


Designs are tested for their susceptibility to local defects.



Selection of the most stable solution through the shortest distance to a predefined target vector.

- **Distance Selection (Euclidean)**



Optimization objectives in the seal case study

	Objective	Fokus der Optimierung	Weighting (Direction vector)
1	Force path	Control of deformation behavior	High
2	Manufacturability	Complexity of the injection molding process	High
3	Max. stress	Structural integrity of the elastomer	Medium