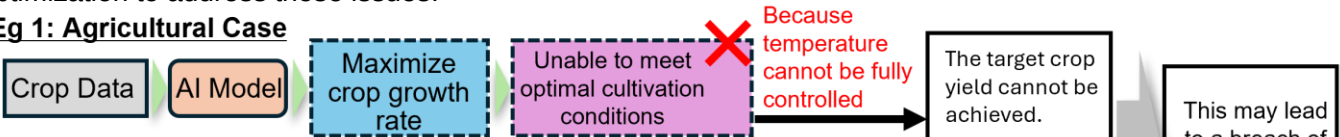


Robust Optimization Using Multi-Sigma®

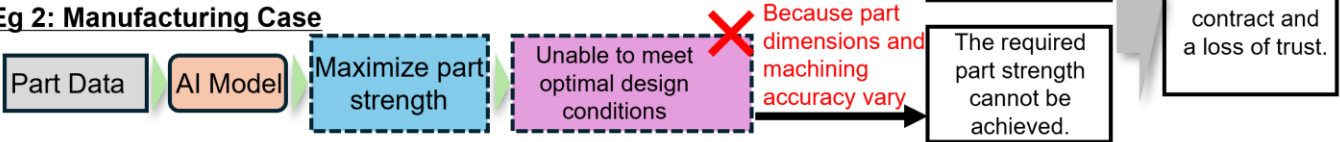
1. Motivation for Robust Optimization

When you run optimization with the Multi-Sigma® no-code AI analytics platform, you can identify input conditions that best drive your target outputs toward desired values. In practice, however, some inputs are readily controllable while others are not. For hard-to-control inputs, even if you set them to the optimized values, they are subject to variation and may drift from their setpoints. As a result, the desired outputs may not be achieved, and minimum requirements (specifications) may not be met. Multi-Sigma® offers robust optimization to address these issues.

Eg 1: Agricultural Case



Eg 2: Manufacturing Case



2. Example of Robust Optimization Using Multi-Sigma® (Manufacturing Data)

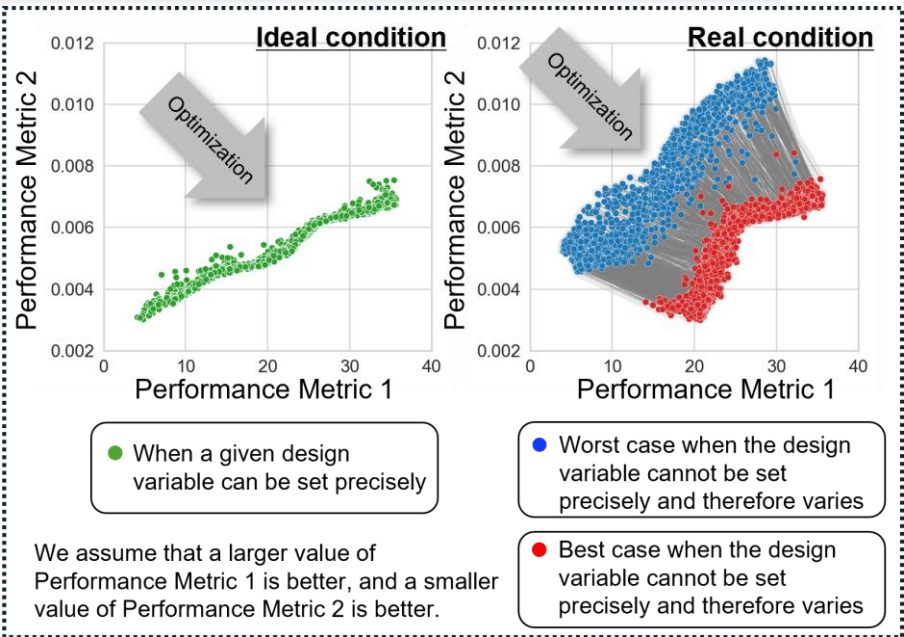
In this manufacturing example, two performance metrics are optimized. Under ideal conditions, the design variable is fixed precisely, forming a clear trade-off curve (left). When variation occurs, Multi-Sigma® quantifies its impact, showing best (red) and worst (blue) cases in the trade-off space (right).

Left plot

Pareto-optimal solution, assuming the hard-to-control design variable is fixed at its ideal value.

Right plot

The best-case (red) and worst-case (blue) Pareto solutions when variation within a specified range is taken into account.



In a manufacturing process, when a design variable that is difficult to control fluctuates within a certain range, the best strategy is to refer to the blue points in the right-hand plot. By selecting the point on the worst-case Pareto front (blue boundary curve) closest to the desired performance, Multi-Sigma® identifies the optimal settings for the remaining design variables that maintain Pareto-optimal performance even under the worst-case variation.

This robust optimization approach stabilizes quality (reducing out-of-spec outcomes and deviations), improves production stability (limiting re-adjustments), and lowers risk (by accounting worst-case conditions). Ultimately, it builds customer trust.

AIZOTH inc. provides a range of AI services, including Multi-Sigma®, AI consulting, experimental condition optimization support, and contract research and development. Multi-Sigma® is a cloud-based AI software designed for research and development, significantly reducing experimental workload and enabling researchers to discover innovative solutions to real-world challenges with minimal experimental datasets.

<https://aizoth.com/en/service/multi-sigma/>
info@aizoth.com

