

# TAGUCHI METHODS FOR ROBUST OPTIMIZATION

ENGINEER CERTAINTY. LEAD THE STANDARD.

## DESIGN PRODUCTS AND PROCESSES THAT PERFORM CONSISTENTLY IN THE REAL WORLD — BY DESIGN, NOT BY LUCK.

TMRO is built for professionals who design, develop, manufacture or assure products and processes — helping teams move from repeated trials to structured experimentation, robust optimisation and confident decisions.

### THE TMRO ADVANTAGE

 01

#### Fewer, smarter trials

Reduce experimentation by studying multiple factors systematically.

 02

#### Better design & process settings

Identify the combination of parameters that delivers the desired performance.

 03

#### Robust performance

Design products and processes to perform consistently despite variation.

 04

#### One clear measure

Compare alternatives using a structured performance measure rather than fragmented results.

 05

#### Learning through application

Expert-led learning, industry cases and a live Action Learning Project.

### LEARNING JOURNEY



Expert-led learning & case studies



Application on a real workplace problem through an Action Learning Project



Certificate, peer collaboration & Community of Practice

### WHO IS THIS FOR?

#### R&D & design

Develop products that perform consistently across real-world conditions.

#### Process planning

Identify robust process settings with fewer experimental trials.

#### Manufacturing systems

Reduce process variation, defects and repeated experimentation.

#### Quality assurance

Understand the parameters that drive quality and build robust processes.

# ONE ROBUST OPTIMIZATION CAPABILITY. MULTIPLE BUSINESS OUTCOMES.

TMRO can help organisations address product and process challenges involving:

## ✓ QUALITY

Which parameters actually drive product and process quality?

## 🔍 VARIATION

How can performance remain consistent when conditions change?

## ≡ COST

How can we improve performance without increasing cost?

## 🕒 TIME

How can we reduce experimentation and reach the right settings faster?

## 🧩 YIELD

Which combination of factors can maximise output and minimise loss?

## 🔒 RELIABILITY

How can we design products and processes that remain robust in the real world?

## 🎯 PERFORMANCE

Which design or process combination delivers the best overall result?

**One method. Every product or process where variation matters.**

## FROM PROBLEM TO ROBUST SOLUTION

### BUSINESS / TECHNICAL PROBLEM

What performance needs to improve?

### CRITICAL FACTORS

Which controllable and uncontrollable factors matter?

### EXPERIMENT DESIGN

Which combinations should be tested?

### ANALYSIS

What does the experimental evidence tell us?

### OPTIMIZATION

Which settings deliver the best robust performance?

### WORKPLACE APPLICATION

How can the solution be implemented and standardised?

## BUILT TO WIN OVER THE WHOLE COMPANY

### A technical advantage

Engineers and quality professionals gain a structured capability to solve complex optimisation problems with fewer trials.

### A business advantage

Organisations improve performance, reduce variation and lower the cost of experimentation, defects and rework.

## THE TMRO PROMISE

Fewer trials. Better settings.

Robust performance. Lower variation.

Design for reality. Not just specification.

**Build robust optimisation as a capability.**

## WHERE CAN ROBUST OPTIMIZATION CREATE VALUE?

TMRO can be applied wherever products or processes are influenced by multiple factors, variation and uncertainty. Each opportunity below reads as challenge, TMRO application and potential impact.

### 01 AEROSPACE

#### Component & structural design **Fewer design iterations**

Strength, weight and design variables interact →  
Optimise critical design parameters

#### Manufacturing processes **Higher consistency, lower rejection**

Material, machine & process variation → Identify robust process settings

#### Material & process selection **Evidence-based selection**

Material & processing choices interact → Compare alternatives systematically

#### Fatigue & durability **Improved reliability & service life**

Loads, temperature & conditions vary → Design against key noise factors

#### Assembly & joining **Fewer defects & rework**

Fit, torque & joining conditions vary → Optimise critical assembly parameters

### 02 PHARMACEUTICALS

#### Formulation **Faster development**

Ingredient interactions affect performance → Optimise formulation variables

#### Granulation & blending **Better batch consistency**

Moisture, mixing & material variation → Identify robust process settings

#### Tablet compression **Fewer defects & trial batches**

Pressure, speed & material properties interact →  
Optimise critical process parameters

#### Coating **Consistent coating performance**

Temperature, spray rate & airflow vary → Develop robust operating settings

#### Stability & quality **Improved product robustness**

Environmental conditions influence attributes → Design around control & noise factors

### 03 INFRASTRUCTURE

#### Concrete mix design **Consistent strength & durability**

Material quality & moisture vary → Optimise mix parameters

#### Road & pavement performance **Longer service life**

Traffic, temperature & material conditions vary → Identify robust design combinations

#### Construction processes **Fewer defects & rework**

Execution varies across teams & sites → Optimise critical process parameters

#### Structural design **Better performance-to-cost balance**

Strength, cost & design variables compete → Evaluate robust design combinations

#### Materials & surface treatment **Improved lifecycle performance**

Environmental exposure affects durability → Design for resistance to noise factors

### 04 HEALTHCARE

#### Medical device design **Safer, more reliable devices**

Patient, usage & environmental conditions vary →  
Optimise critical design parameters

#### Device manufacturing **Fewer defects & rework**

Process variation affects functional quality → Identify robust manufacturing settings

#### Diagnostic systems **More consistent diagnostics**

Multiple parameters affect accuracy → Optimise operating conditions

#### Sterilisation **Reliable sterilisation performance**

Time, temperature & material factors interact →  
Determine robust process settings

#### Healthcare processes **More consistent service**

Patient & operational variation affects outcomes →  
Optimise process factors around CTQs

**05 AUTOMOBILE****Powertrain performance** **Better efficiency & performance**

Parameters interact with load & operating conditions → Optimise robust performance settings

**Product & structural design** **Fewer design iterations**

Weight, strength, NVH & cost trade-offs → Optimise design parameters systematically

**Manufacturing processes** **Higher FPY, lower variation**

Machine, material & operator variation → Develop robust process windows

**Paint & surface quality** **Lower rejection & rework**

Temperature, humidity & settings affect finish → Optimise paint process parameters

**Assembly & joining** **Lower warranty risk**

Torque, alignment & fit variation → Identify robust assembly settings

**06 CHEMICAL INDUSTRIES****Formulation** **Consistent product performance**

Raw-material variation changes properties → Optimise robust formulation combinations

**Reaction conditions** **Higher yield & productivity**

Temperature, pressure, time & concentration interact → Optimise critical process parameters

**Paint & coating** **Better finish, lower rejection**

Viscosity & application conditions vary → Optimise formulation & process settings

**Mixing & dispersion** **Better batch consistency**

Mixing energy, time & material properties vary → Determine robust mixing conditions

**Energy & resource efficiency** **Lower energy & operating cost**

Higher performance can raise consumption → Compare factor combinations systematically

**07 ELECTRONICS / SEMICONDUCTORS****Yield optimisation** **Higher yield**

Small parameter changes shift yield → Identify critical process parameters

**Fab capacity & equipment** **Better utilisation**

Expensive assets, constrained capacity → Optimise equipment & process settings

**Etching & deposition** **Improved process consistency**

Temperature, pressure, gas flow & time interact → Determine robust process conditions

**Assembly & soldering** **Fewer defects, better reliability**

Thermal profiles & material variation affect joints → Optimise assembly parameters

**Reliability & testing** **Improved product reliability**

Thermal, electrical & mechanical conditions vary → Design experiments around noise factors

**08 TEXTILE / LEATHER****Fabric development** **Consistent fabric properties**

Fibre, yarn & process variables affect quality → Optimise material & process combinations

**Dyeing & finishing** **Better colour consistency**

Temperature, time, chemicals & water quality vary → Identify robust process settings

**Weaving & knitting** **Higher productivity**

Machine settings & material variation create defects → Optimise machine & process parameters

**Leather processing** **Consistent quality, lower rejection**

Raw-material variability affects finish & strength → Develop robust processing conditions

**Coating & surface treatment** **Improved finish & performance**

Application conditions affect appearance & durability → Optimise formulation & process parameters

WANT TO BUILD ROBUST OPTIMISATION AS AN ORGANISATIONAL CAPABILITY?

**DESIGN BETTER. EXPERIMENT SMARTER. PERFORM CONSISTENTLY.**

TMRO · Taguchi Methods for Robust Optimization — built for anyone who designs, builds or checks products and processes.

TO KNOW MORE, CONTACT US

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