

OptimiSE

# Corporate Training

Programme Overview



Prepared by:

Joy Au

● Public

# Table of Contents

<u>Overview</u>	3
<u>MDO for Systems Engineers</u>	4
Programme Outline	4
Day 1: Numerical Analysis and Optimisation	4
Day 2: Gradient-based Optimisation	4
Day 3: Advanced Optimisation Techniques	5
Day 4: Multidisciplinary Design Optimisation	5
Day 5: Multi-Objective Optimisation	5
<u>Systems Engineering and MBSE</u>	6
Programme Outline	6
Day 1: Foundations of Systems Engineering	6
Day 2: Conceptualising Complex Systems	6
Day 3: Modelling Systems with OPM	7
Day 4: Design Validation	7
Day 5: Product Verification	7
<u>Practical MDO with MBSE</u>	8
Programme Outline	8
Day 1: Overview of MDO x MBSE	8
Day 2: System Modelling	8
Day 3: Domain Analyses	9
Day 4: Integrating MDO with MBSE	9
Day 5: Data Analytics and Business Intelligence	9
<u>Next Steps</u>	10

## Overview

At OptimiSE, we help organisations unlock the full potential of their engineering teams through targeted corporate training in Multidisciplinary Design Optimisation (MDO) and Model-Based Systems Engineering (MBSE). These capabilities aren't just technical add-ons — they're strategic enablers that shorten development cycles, reduce risk, and deliver better-performing systems. Whether you're building complex products, optimising existing designs, or modernising your engineering workflows, our programmes equip your team with skills that make a measurable impact.

Our courses can be delivered virtually or in-person and are designed to be practical from day one. Every participant receives comprehensive lecture notes, completed coding or modelling exercises to take away, and complimentary licenses to the tools used during the course. If you have preferred software or a specific tech stack, we're happy to tailor the setup to match your environment.

The programmes outlined in this brochure are carefully curated to cover the complete MDO x MBSE methodology, but they are far from one-size-fits-all. We can adapt content to suit your organisation's tools, processes, and infrastructure, or integrate additional topics to address your specific capability gaps.

While the three core courses are interrelated and designed to complement each other, they are also independent enough to be taken separately. For the most comprehensive experience, we recommend booking the full suite. Alternatively, you can work with us to build a custom syllabus, mixing and matching topics from each course to create a learning path that best fits your goals.

# MDO for Systems Engineers

As systems grow in complexity and the competitive landscape intensifies, systems engineers must innovate and optimise not only for feasibility but for ultra-high performance.

This course is designed for organisations striving for such excellence. From foundational principles in numerical optimisation to advanced, hands-on techniques, this course equips engineers with the skills needed to confidently implement Multidisciplinary and Multi-Objective Design Optimisation using industry tools and practical exercises.

## Programme Outline

### Day 1: Numerical Analysis and Optimisation

Easing into the world of numerical optimisation, on the first day we're going to cover:

- Introduction to mathematical optimisation
- Exercise: Linear and quadratic programming
- Numerical models, linear and nonlinear solvers
- Exercise: Solving implicit functions

### Day 2: Gradient-based Optimisation

On Day 2, we'll focus on gradient-based optimisation, the most efficient optimisation method:

- Computing derivatives
- Exercise: Comparing algorithms
- Optimality conditions
- Exercise: Solving unconstrained problems
- Exercise: Solving constrained problems

## Day 3: Advanced Optimisation Techniques

With foundational knowledge on numerical optimisation, it's time to explore advanced techniques that are essential for practical applications:

- Surrogate-based optimisation
- Exercise: Optimising surrogate models with infill
- Optimisation under uncertainty
- Exercise: Robust and reliable optimisation

## Day 4: Multidisciplinary Design Optimisation

Applying the knowledge and techniques we learned, on Day 4, we're going to implement Multidisciplinary Design Optimisation (MDO):

- MDO problem formulation
- Understanding models and coupling variables
- Exploring MDO architectures
- Exercise: Optimising a complex system

## Day 5: Multi-Objective Optimisation

Going up a level, we'll master how Multi-Objective Optimisation (MOO) helps balance competing objectives and drive a more informed decision:

- Gradient-free optimisation
- Exercise: Solving optimisation problems using genetic algorithms
- MOO problem formulation and pareto optimality
- MOO methods and algorithms
- Exercise: Conducting a trade-off analysis of a complex system

# Systems Engineering and MBSE

In today's increasingly complex systems, mastering solid systems engineering principles and Model-Based Systems Engineering (MBSE) techniques is crucial for effective and successful system development.

Whether you're a design optimisation professional, a systems engineer seeking a refresher, or someone new to MBSE, this programme's blend of comprehensive lectures and hands-on modelling exercises will equip you with the essential skills to excel in complex system development.

## Programme Outline

### Day 1: Foundations of Systems Engineering

A strong foundation of systems knowledge is essential in systems engineering. On the first day, we'll cover:

- Systems thinking and its application
- The system development lifecycle
- Systems engineering framework
- Identifying needs and opportunities
- Exercise: Developing a business case

### Day 2: Conceptualising Complex Systems

Based on the work developed in Day 1, we'll begin to conceptualise a complex system:

- Defining the ConOps
- Conducting functional analysis
- Establishing architecture baselines
- Exercise: Presenting the system concept
- Exercise: Creating a system development plan

## Day 3: Modelling Systems with OPM

After a day of free-flowing creativity, on Day 3, we'll formalise the system concept using Object Process Methodology (OPM):

- Overview of systems theory
- Understanding objects, processes and relations
- Modelling and managing system complexity
- Exercise: High-level system model creation

## Day 4: Design Validation

System development is an iterative process. Taking the concept developed previously, on Day 4, we'll validate and refine the design:

- Effective requirements management
- Operation semantics and control links
- Exercise: Detailed system model development

## Day 5: Product Verification

Finally, it's time to perform some testing and verification on the system we've developed so far:

- Managing facts and data integrity
- Simulation and model execution techniques
- Exercise: Verifying and reporting the success (or failure!) of your system

# Practical MDO with MBSE

If your organisation faces inefficiencies in system development or struggles to achieve optimal design outcomes, this course is for you.

Covering the complete Multidisciplinary Design Optimisation (MDO) and Model-Based Systems Engineering (MBSE) methodology, this course empowers your team to implement a microservice architecture and drive design optimisation from system models. By integrating advanced data analytics techniques, it equips your team with the tools to foster collaboration between engineering and business, creating a unified approach to system development.

## Programme Outline

### Day 1: Overview of MDO x MBSE

Setting the stage with MBSE-driven MDO, on Day 1, we'll cover the foundational concepts and explore the design problem:

- Microservice architecture and its role in optimisation
- Use case selection for MDO applications
- Exercise: Identifying design challenges and opportunities
- Exercise: Defining design and optimisation strategies

### Day 2: System Modelling

Based on the information given, we'll begin to develop the system concept and create its model representation:

- Defining system architecture
- Understanding system behaviour
- Simulating system models
- Exercise: Creating an MBSE model

## Day 3: Domain Analyses

Diving into each domain, on Day 3, we'll perform detailed analysis and optimisation using a diverse range of techniques:

- Formulating and evaluating domain models
- Comparing algorithms and performance
- Detailed domain optimisations
- Exercise: Developing MDO models for specific domains

## Day 4: Integrating MDO with MBSE

With the system and domain models set up, we're now ready to perform the integration to enable a MBSE-driven MDO:

- Developing and refining optimisation models
- Connecting models via API for system-wide integration
- Orchestrating MDO using MBSE
- Exercise: Evaluating and reporting optimal solutions

## Day 5: Data Analytics and Business Intelligence

To further elevate and enhance the system development experience, we'll go up a level and explore:

- Visualising and interpreting data from design optimisation
- Conducting trade studies and utilising business intelligence
- Automation and AI-powered tools to enhance decision-making
- Exercise: Rationalising design decisions based on data
- Exercise: Final product presentation and analysis

## Next Steps

Our programmes are built to deliver a measurable return on investment. By the end of each course, your team will not only understand the principles of MDO and MBSE but will be able to apply them directly to your organisation's projects — improving design efficiency, reducing rework, and making better decisions earlier in the development cycle. The methods, tools, and exercises provided are chosen to create immediate impact, building skills that continue to deliver value long after the course ends.

Our pricing is transparent and scalable. Courses start from the rates below based on a group of five participants, excluding VAT and applicable taxes. They are typically delivered over five to seven days, with the schedule tailored to your team's needs and experience level. Customisation packages are quoted separately to suit your tools, workflows, and objectives.

Course	Duration	Price
<i>MDO for Systems Engineers</i>	5 - 7 days	\$17,500 USD
<i>Systems Engineering and MBSE</i>	5 - 7 days	\$17,500 USD
<i>Practical MDO with MBSE</i>	5 - 7 days	\$20,000 USD

\* Prices are available in USD, GBP, or EUR.

If you're interested in bringing any of these programmes to your organisation, email us at [hello@optimise.systems](mailto:hello@optimise.systems). We'll be happy to discuss your goals, confirm the best course fit, and prepare a tailored proposal.