

CHARTERED 
INSTITUTE OF PROFESSIONAL CERTIFICATIONS

ADVANCED STRUCTURAL DYNAMICS, ANALYSIS AND MODELLING

**Fully Accredited
By:**

Chartered Institute of
Professional Certifications

CPD
Certification Service

PROGRAM OVERVIEW



Advanced structural dynamics and analysis is becoming more important due to the increasing use of **novel materials, unconventional structural systems, and more slender and flexible designs**. These modern approaches enable architectural creativity and efficiency but also introduce complex dynamics that require rigorous analysis to ensure safety and resilience against wind, earthquakes, and other dynamic loads.

This certified **Advanced Structural Dynamics, Analysis and Modelling** program will provide you with an in-depth understanding of advanced structural dynamics and their real-world implications. Participants will gain comprehensive knowledge that helps them to analyze and model structural dynamics and their responses. You will learn vital concepts, from **single-degree-of-freedom (SDOF) and multi-degree-of-freedom (MDOF) systems to the intricacies of time domain and frequency domain analyses, as well as modal analysis**.

Moreover, this program will enhance your understanding of **dynamic stiffness, refine your skills in forecasting structural dynamic behaviors, and help you master the formulation of motion equations for continuously vibrating beams**. A significant component of the course also focuses on **seismic engineering and soil dynamics**, equipping you with the expertise to design earthquake-resistant structures and understand the complexities of soil-structure interactions during dynamic loading. In addition, participants will develop a strong ability to identify structural vulnerabilities using cutting-edge analysis methods and devise robust design solutions to guard against potential structural failures while ensuring compliance with the latest industry codes and standards.

Upon successful completion of the program, you will attain the **Certification in Advanced Structural Dynamics, Analysis and Modelling**. This distinguished certification will elevate your professional standing and demonstrate your expertise in applying structural dynamics and your ability to identify structural vulnerabilities through meticulous structural analysis. Globally demanded and recognized, the certification holds lifelong validity, testifying to your expertise and dedication to excellence in the structural dynamics.

ACCREDITATIONS



4.8



4.6



KEY SKILLS YOU WILL GAIN

From This Program



**STRUCTURAL DYNAMICS
PROBABILISTIC MODELS
RANDOM VIBRATION
EARTHQUAKE ENGINEERING**

**MULTI DEGREE OF FREEDOM STRUCTURES
SINGLE DEGREE OF FREEDOM STRUCTURES
DYNAMIC RESPONSE OF STRUCTURES
SPECTRAL DENSITY FUNCTION**

**LINEAR RESPONSE SPECTRA
STRONG GROUND MOTION
MODAL ANALYSIS
TIME DOMAIN ANALYSIS**

**STRUCTURAL MECHANICS
LINEAR AND NONLINEAR METHODS OF
STRUCTURAL ANALYSIS
FOURIER SERIES
VIBRATION ANALYSIS
TRANSCENDENTAL EQUATION**

**BLAST LOADS
GAUSSIAN QUADRATURE**

YOUR FACULTY DIRECTOR



Dr. Donya Hajjalizadeh

Award Winning Structural Dynamics Expert

Dr. Donya Hajjalizadeh, an **award-winning Chartered Engineer and Senior Lecturer in Structural Engineering at the University of Surrey**, is renowned for her expertise in structural dynamics. Her academic credentials, including a PhD from University College Dublin, where **she was awarded the prestigious Marie Curie Scholarship**, and her professional designations (CEng MICE, MIEI, EUR ING, MWES, FHEA), underscore her standing in the engineering community.

Dr. Hajjalizadeh's industry experience includes a significant tenure as a **Research Engineer at Roughan & O'Donovan Innovative Solutions and as a part-time lecturer**, before her roles at Anglia Ruskin University and the University of Surrey. Her specialization in structural dynamics is a cornerstone of her research and teaching, **focusing on cutting-edge methodologies like structural health monitoring, data-driven and machine learning-based asset management systems**, and the assessment of risk and reliability in bridges.

A prominent member of several engineering bodies and a manuscript peer reviewer for esteemed journals, Dr. Hajjalizadeh's contributions to the field extend beyond academia. Her lectures on earthquake engineering, structural mechanics, and particularly structural dynamics, alongside her research in bridge weigh-in-motion and traffic load modelling, highlight her commitment to advancing structural engineering's knowledge base. Dr. Hajjalizadeh's work is pivotal in shaping the future of structural engineering, with a focus on enhancing the resilience, vulnerability, and risk assessment of critical infrastructure through innovative approaches in structural dynamics.

OUR PARTICIPANTS

Over 70% of FORTUNE 500 Companies Have Attended Our Accredited Programs Before





PROGRAM AGENDA

MODULE 1 - FUNDAMENTALS OF STRUCTURAL DYNAMICS

- Lesson 1 - What is Structural Dynamics?
- Lesson 2 - Difference Between Dynamic System and Static System
- Lesson 3 - 3-dimensional Stress-Strain Relationships
- Lesson 4 - Stiffness Matrix of Linear Structural Systems
- Lesson 5 - Inertial/Mass Properties of Structural Systems
- Lesson 6 - Degrees of Freedom
- Lesson 7 - Modelling of Vibrating Structural Systems
- Lesson 8 - Static Condensation for Model Order Reduction

MODULE 2 - SINGLE DEGREE OF FREEDOM SYSTEMS

- Lesson 1 - Free Vibration Response
- Lesson 2 - Measures of Damping
- Lesson 3 - Response to Harmonic Excitation
- Lesson 4 - Response to Periodic Loading: Fourier Analysis
- Lesson 5 - Case Study: Human Comfort Design in Floor Slabs

MODULE 3 - TIME AND FREQUENCY DOMAIN VIBRATION ANALYSIS OF SDOF

- Lesson 1 - Convolution Integral in Time Domain
- Lesson 2 - Numerical Methods for Time Integration
- Lesson 3 - Linear Response Spectra in Earthquake Engineering
- Lesson 4 - Convolution Theorem and Spectral Analysis
- Lesson 5 - Case Study: Soil Modelling for Earthquake Response

MODULE 4 - MODAL ANALYSIS OF MULTI DEGREE OF FREEDOM SYSTEMS

- Lesson 1 - Eigenvalue Problem and Normal Modes
- Lesson 2 - Interpretation of Undamped Modes of Vibration
- Lesson 3 - Numerical Methods for Modal Analysis
- Lesson 4 - Natural Frequency Estimation Techniques
- Lesson 5 - Complex Modes for Non-Classically Damped Systems
- Lesson 6 - Case Study: Modal Analysis of a 50-Storey Building



PROGRAM AGENDA

MODULE 5 - VIBRATION ANALYSIS OF MDOF SYSTEMS

Lesson 1 - Orthogonal Modal Expansion
Lesson 2 - Mode Superposition Method
Lesson 3 - Modal Response Spectrum Method for Earthquake Analysis

MODULE 6 - MODAL ANALYSIS OF CONTINUOUS STRUCTURES

Lesson 1 - Equations of Motion of Vibrating Continuous Systems
Lesson 2 - Eigenvalue Problem for Continuous Vibrating Beams
Lesson 3 - Exact Modal Analysis for Simple Continuous Systems

MODULE 7 - VIBRATION ANALYSIS OF CONTINUOUS STRUCTURES

Lesson 1 - Orthogonal Modal Expansion for Continuous Systems
Lesson 2 - Mode Superposition Method for Continuous Vibrating Beams

MODULE 8 - APPROXIMATE MODELING OF CONTINUOUS STRUCTURES

Lesson 1 - Single Mode Approximations for Continuous Systems
Lesson 2 - Case Study: Industrial Chimney Analysis

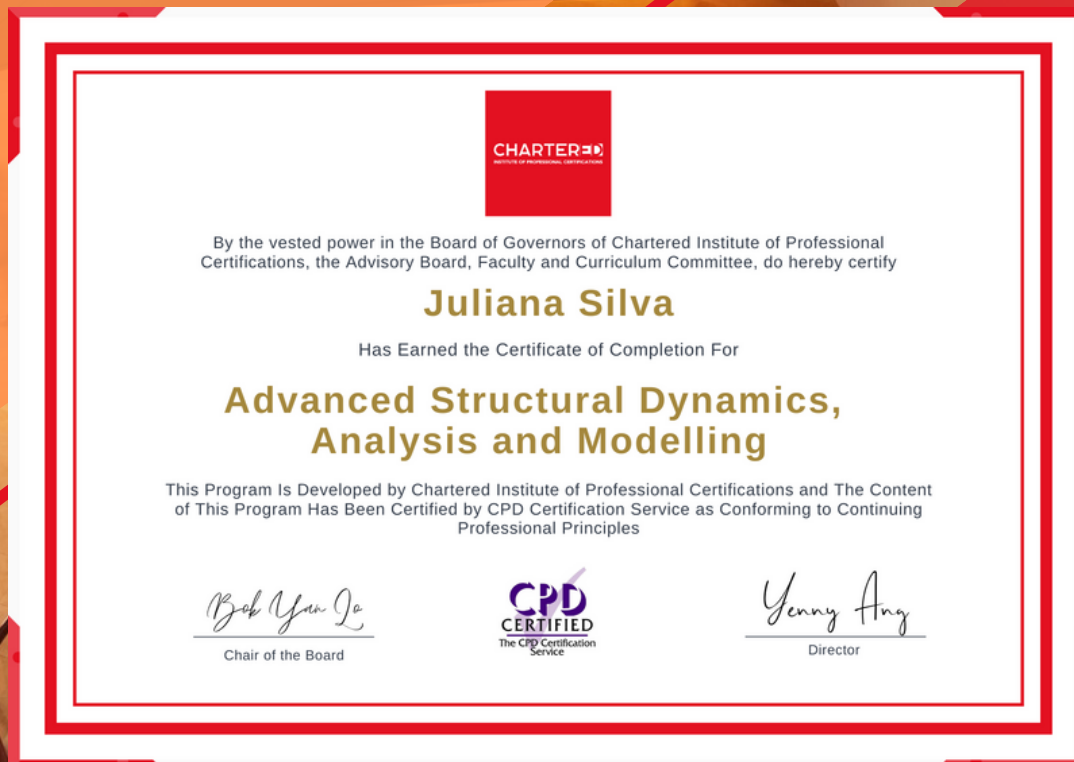
MODULE 9 - TUNED MASS DAMPERS FOR MITIGATION OF STRUCTURAL VIBRATIONS

Lesson 1 - Concept of Dynamic Vibration Absorbers
Lesson 2 - Optimal Tuning Formulae
Lesson 3 - Case Study: Tuned Mass Damper Applications

MODULE 10 - VIBRATION SERVICEABILITY IN SLENDER STRUCTURES

Lesson 1 - Dynamic Load Resisting Systems of Tall Buildings
Lesson 2 - Floor Acceleration Design for Wind and for Foot-Induced Vibrations
Lesson 3 - Substructure Supporting Systems for Wind Turbines
Lesson 4 - Design of Wind Turbine Substructure for Wind and Wave Vibrations

YOUR CHARTER DESIGNATION



Chartered Institute of Professional Certification's programs are unique as they provide you with professional charter designation and mark that can be used across your lifetime once you have completed our programs.

Upon successfully attending this program, you will be awarded with the **Certification in Advanced Structural Dynamics, Analysis and Modelling** that can be used in your resume, CV and other professional credentials. This certification is industry-recognized with lifelong validity.

Globally demanded and recognized, this certification will amplify your professional qualifications and demonstrate your expertise in **navigating the intricacies involved in structural dynamics, including analyze and predict structural behavior under various loads and conditions**. Developed by **Chartered Institute of Professional Certifications**, the content of this program has been independently accredited by **CPD Certification Service** as adhering to the highest standards of continuing professional principles.

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390

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CONTACT US TODAY

We Thank You for Your Ongoing Support
of Our Programs

Singapore and Asia Pacific Enquiries

Email: advisor@charteredcertifications.com
Phone: +65 6716 9980
Address: Chartered Institute of Professional Certifications
1 Gateway Drive
#20-04 Westgate Tower
Singapore 608531

Australia and New Zealand Enquiries

Email: advisor@charteredcertifications.com
Phone: +61 3 9909 7310
Address: Chartered Institute of Professional Certifications
530 Little Collins Street, Level 1
Melbourne VIC 3000, Australia

UK, Europe and Middle East Enquiries

Email: advisor@charteredcertifications.com
Phone: +44 (020) 335 57898
Address: Chartered Institute of Professional Certifications
86-90 Paul Street
London, EC2A 4NE

USA Enquiries

Email: advisor@charteredcertifications.com
Phone: +1 888 745 8875
Address: Chartered Institute of Professional Certifications
99 Wall Street #3936
New York, NY 10005