

# Computations for Historical Masonry

## Overview

Historical structures are primarily brick or stone masonry constructions, either with lime mortar used as a binding material, or dry-stacked. Unreinforced masonry displays complex non-linear mechanical behaviour, characterised by low tensile strength and high stiffness. Structural modelling and analysis of structural components or systems in monumental buildings is a crucial step in understanding the behaviour of these structures under different loading conditions. Masonry is an anisotropic material, exhibiting distinct directional properties due to the mortar joints, which are planes of weakness. The non-linear response of the unit-mortar interface, i.e., the bond between the unit (brick, stone, etc.) and the mortar, is typically the weakest link and dictates the masonry behaviour. At the interface, either tensile failure or shear failure occurs. Several approaches for structural analysis of historical buildings are available in the literature, spanning from simple analytical tools to complex non-linear mathematical formulations. Several developments in numerical tools available for structural analysis of historical buildings have been observed in the past decades. Safety assessment requires quantitative inputs, and quantitative analysis is relevant in the context of heritage structures too.

The objectives of the course are:

- (1) To identify the role of quantitative analysis in the safety assessment of historical constructions, particularly historical masonry constructions.
- (2) To develop a framework for the choice of modelling and analysis possibilities depending on the requirements of the actual engineering problem at hand.
- (3) To identify issues, methods, requirements and possibilities of modelling and analysis of historical masonry structures.

This course is being conducted as part of the educational activities of **National Centre for Safety of Heritage Structures (NCSHS)**, IIT Madras ([www.ncshs.org](http://www.ncshs.org)).

<b>Course Dates</b>	<b>01 – 11 March 2016</b>								
<b>Host Institute</b>	<b>IIT Madras</b>								
<b>No. of Credits</b>	<b>2</b>								
<b>No. of Participants</b>	<b>50 (maximum)</b>								
<b>You Should Attend If...</b>	<ul style="list-style-type: none"><li>▪ You are a structural engineer or research scientist interested in structural analysis of historical constructions.</li><li>▪ You are conservation engineer or architect interested to learn about the role of quantitative structural analysis in your profession.</li><li>▪ You are a student or faculty from academic institution interested in pursuing research on structural aspects of historical constructions.</li></ul>								
<b>Course Registration Fees</b>	<p>The participation fees for taking the course is as follows:</p> <table><tr><td><b>Student Participants:</b></td><td>Rs.2000</td></tr><tr><td><b>Faculty Participants:</b></td><td>Rs.6000</td></tr><tr><td><b>Government Organizations:</b></td><td>Rs.10000</td></tr><tr><td><b>Industry Participants:</b></td><td>Rs.20000</td></tr></table> <p>The above fee is towards participation in the course, the course material, computer use for tutorials and assignments, and laboratory equipment usage charges.</p> <p><b>Mode of payment: Demand draft in favour of “Registrar, IIT Madras” payable at Chennai</b></p>	<b>Student Participants:</b>	Rs.2000	<b>Faculty Participants:</b>	Rs.6000	<b>Government Organizations:</b>	Rs.10000	<b>Industry Participants:</b>	Rs.20000
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<b>Industry Participants:</b>	Rs.20000								
<b>Accommodation</b>	<p>The participants may be provided with hostel accommodation, depending on the availability, on payment basis. Request for hostel accommodation may be submitted through the link: <a href="http://hosteldine.iitm.ac.in/iitmhostel">http://hosteldine.iitm.ac.in/iitmhostel</a></p>								

## Course Faculty



**Paulo B. Lourenço** is Professor of Structural Engineering at Department of Civil Engineering, University of Minho, Guimarães, Portugal and Head of the Institute in Sustainability and Innovation in Structural Engineering.

He has worked in more than 50 monuments in Portugal, Spain, Italy, Brazil, Cyprus, Iran, India and Morocco. He is Editor of the International Journal of Architectural Heritage: Conservation, Analysis and Restoration, Editor of the Conference Series: Structural Analysis of Historical Constructions and Coordinator of the European Erasmus Mundus Master Course on Structural Analysis of Monuments and Historical Constructions. He is a Senior Fellow and Specialist in Structures of the Portuguese Society of Engineers. He is an invited professor at Technical University of Catalonia (Spain), National Autonomous University of Mexico, IUAV University of Venice (Italy), University of Padua (Italy), Federal University of Minas Gerais (Brazil), University St. Anthony Abad de Cusco (Peru) and University Jean Piaget (Angola), and author of circa 1000 technical and scientific publications.



**B. N. Rao** is Professor of Structural Engineering at the Civil Engineering Department of IIT Madras. He received his PhD in Structures, Mechanics and Materials from University of Iowa, USA. His research interests include developing new computational techniques in the areas of

computational solid mechanics, finite element analysis, meshless analysis, computer-aided design, structural reliability, optimization, stochastic mechanics, fracture analysis and crack propagation simulation studies.



**Anumolu Meher Prasad** is Professor of Structural Engineering and Head of the Department of Civil Engineering at Indian Institute of Technology, Madras. He received his PhD in Civil Engineering, Rice University, USA. His research interests include computer aided design, deterministic and probabilistic structural dynamics, earthquake

engineering, solid dynamics and structural reliability. He was the structural consultant to the Archaeological Survey of India (ASI) for the conservation of Ta Prohm temple in the Angkor Vat Group of Monuments in Cambodia.

## Course Coordinator

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