# Il Metodo 'Component-Wise' nell'Analisi delle Strutture



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### Friday, Feb 7, 2025
**11 am – 12 am**, DICAM, **1D room**

## Abstract

The seminar introduces the method known as 'component-wise' in the analysis of structures composed of several elements connected through kinematic relationships.

The approach is developed through two- and three-dimensional finite elements. Almost all natural and man-made constructions are multi-component structures. Examples are lightweight (and non-lightweight) reinforced shell constructions (aeronautical, naval, civil); structural elements with multiple layers (often called layer-wise); sandwich structures consisting of 'faces' and 'core'; the single layer composite material in turn made up of the two components 'fibre' + 'matrix'; reinforced concrete in which concretes are reinforced with iron wires; masonry consisting of stones component and mortars. Finally, multi-component structures are all 'meta-material' configurations with cells of different geometry, e.g. 'kagome' like and countless other shapes.

The seminar shows how non-classical element formulations based on the Carrera Unified Formulation can be particularly appropriate for the development of component-wise analyses.

In particular, the use of one-dimensional elements using Lagrange and/or Legendre-type polynomial developments on the cross-section allows only pure displacement unknowns to be referred to, and greatly facilitates the connection between the different 'component' elements constituting the structure under investigation.  Linear and nonlinear problems in the static and dynamic case will be discussed.

## About the speaker

Erasmo Carrera is Professor of Aerospace Structures and Aeroleasticity at Politecnico di Torino, Italy. He graduated in Aeronautics in 1986 and Space Engineering in 1988 at the Politecnico di Torino. He obtained a Ph.D. in Aerospace Engineering in 1991. Carrera has introduced the Reissner Mixed Variational Theorem, RMVT, as a natural extension of the Principle of Virtual Displacement to layered structure analysis. He introduced the Unified Formulation, or CUF (Carrera Unified Formulation), as a tool to establish a new framework in which to develop linear and nonlinear theories of beams, plates and shells for metallic and composite multilayered structures loaded by mechanical, thermal electrical and magnetic loadings. Carrera has been author and coauthor of about 800 papers on the above topics, most of which have been published in first rate international journals, including a few recent books. Professor Carrera is founder and leader of the MUL2 group at the Politecnico di Torino.The MUL2 group has acquired a significant international reputation in the field of multilayered structures subjected to multifield loadings, see also www.mul2.com.  Professor Carrera has been recognized as Highly Cited Researchers (Top 100 Scientist) by Thompson Reuters in the two Sections: Engineering and Materials

(2013) and Engineering (2015). He is Editor-in-Chief of Mechanics of Advanced Materials and Structures. He is founder and Editor-in-Chief of Advanced in Aircraft and Spacecraft Sciences. Member of Accademia delle Scienze di Torino, International Academy of Astronautics e Academie de l'Air et l'Espace. He currently acts as President of A.I.D.A.A. (Associazione Italiana di Aeronautica ed Astronautica). He has been Local Chair of IAC Milano 2024, ICAS Florence 2024, AIAA-CEAS Aeroacoustic Rome, 2024. He his currently Technical Chair of ASME-SDDM, Orlando, 2025 and Local Chair of CEAS-AIDAA-SDM Conference, Torino 2025.