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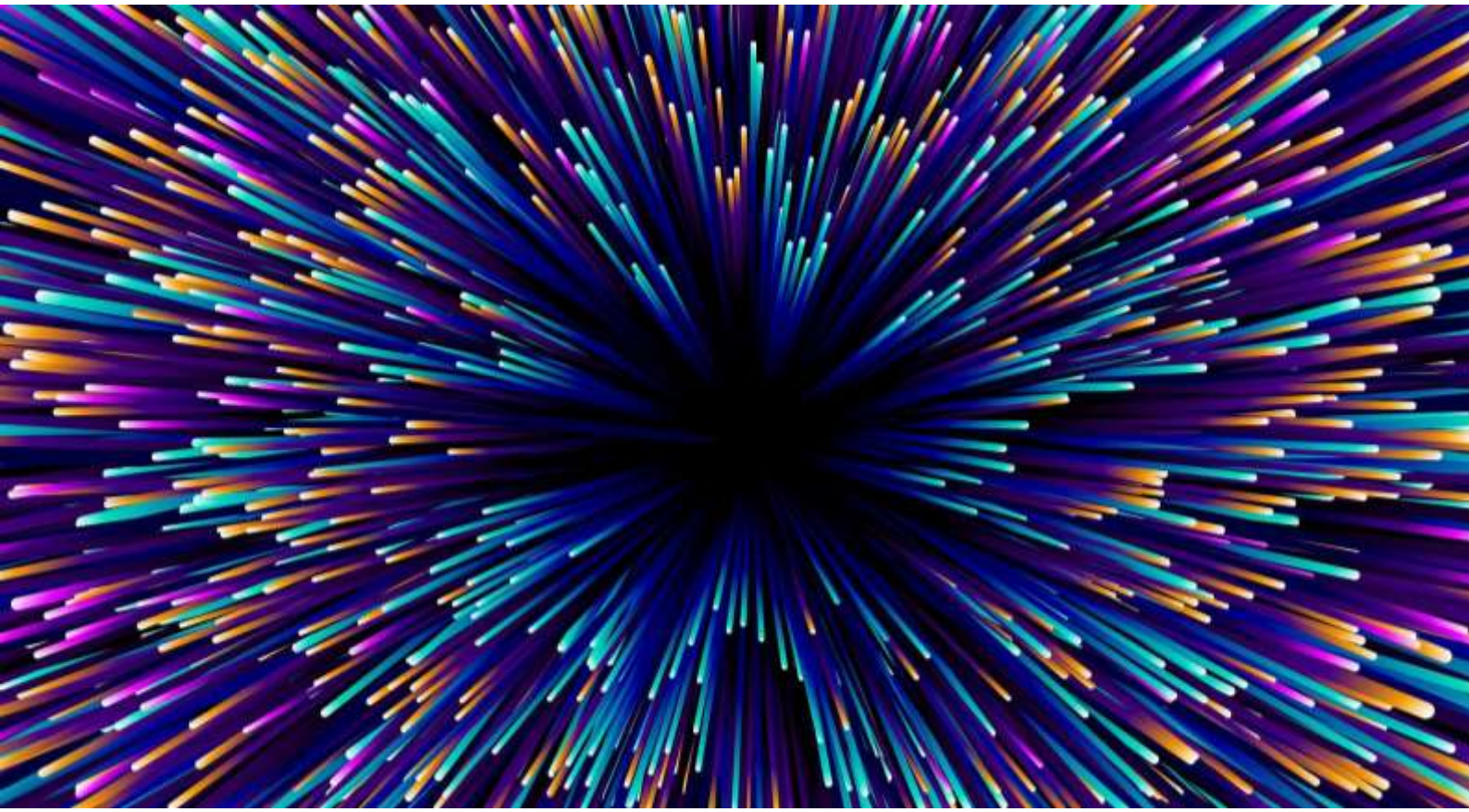

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Lectio Magistralis

Prof. Ing. Luciano Rosati

Frequently used and misused concepts in beam analysis: the center of shear and the center of twist

time

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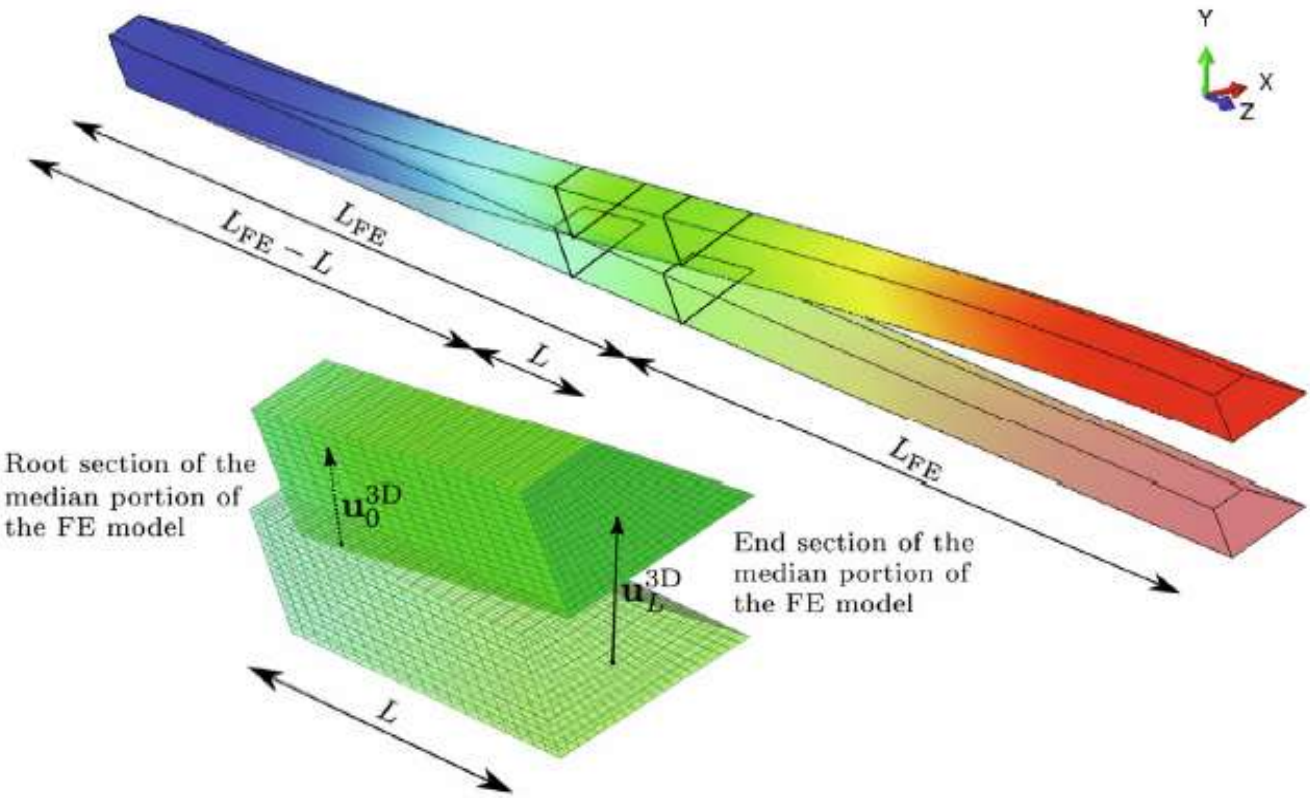

Frequently used and misused concepts in beam analysis: the center of shear and the center of twist

The center of shear and the center of twist are two basic concepts in solid and structural mechanics that often overlaps in a fuzzy way although their meaning and properties are quite different.

Actually, the center of twist is unambiguously defined both for the solid model by Saint Venant and the beam model by Euler-Timoshenko; furthermore, its position depends solely upon the beam cross section. Conversely, the center of shear is unambiguously defined for the solid model while it has two different definitions for the beam model, namely the geometric one by Goodier and the energetic one by Trefftz.

Surprisingly, the second definition of the center of shear provides a point that coincides with the center of twist while the geometric definition yields a point that is not only different from the center of twist but it also depends upon the material properties of the beam.

Moreover, the center of shear tends to coincide with the center of twist in the technically significant case of thin-walled beams or if the Poisson ratio is null, making one naturally ask if the geometric definition, by far the most diffused one in books and softwares, is really necessary.

We provide an answer to this question by proving that the center of twist is the only point that is really legitimate to provide kinematic and energetic uncoupling between shear and torsion both for the solid model and the beam one and to ensure a perfect symmetry with the role played by the center of gravity for normal stresses. We also show that the shear deformability tensor, ensuring kinematic and energetic equivalence between the cantilever beam and the solid model, only depends upon the center of twist and the position of the transverse force.

Prof. Ing. Luciano Rosati

- Graduated with honors in Mechanical Engineering and Civil Transport Engineering.
- PhD in Structural Engineering, II cycle.
- Winner of a NATO-CNR scholarship at the Department of Aeronautics of the Imperial College, Supervisor prof. Mike Criesfield.
- Full Professor of Mechanics of Solids and Structures - Scienza delle Costruzioni at the University of Naples Federico II since 1 November 2001.
- Member of the National Secretariat of the SSD ICAR / 08 - Scienza delle Costruzioni, 2004-2010.
- Coordinator from 2012 to 2018 of the PhD in Structural, Geotechnical Engineering and Seismic Risk of the University of Naples Federico II.
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- President of Società Italiana di Scienza delle Costruzioni (SISCo) since February 2021
- Director of the Interdepartmental Center for Cultural Heritage (CIBeC) since March 2021
- Author of over one hundred scientific papers published in national and international journals and conference proceedings.

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