

## SCHEMA PER LA RELAZIONE ANNUALE DEL DOTTORANDO CICLO Anno

- Nome e Cognome    Guohong LI
- Dottorato in    **INGEGNERIA MECCANICA**
- Ciclo XXXI    Anno di Corso    2016/2017
- Dipartimento di appartenenza    DIMEAS
- Coordinatore            **Prof. Luigi GARIBALDI**
- Tutore            Prof. Erasmo Carrera
- Area Culturale di Interesse (in Italiano e Inglese)  
  Simulazione numerica di strutture in composito / Numerical simulation of composite structures
- Breve descrizione dell'argomento della tesi o dell'Area Culturale di Interesse (massimo 20 righe, in Italiano e Inglese)

ESR1 under FULLCOMP project is focused on the development of variable, mixed, linear and nonlinear kinematic shell formulations accounting for thermal, hygrothermal, piezoelectric and magnetic effects. CUF (Carrera Unified Formulation) provides a general framework to construct refined 1D and 2D models for the analysis of multi-layered structures. Various series expansions (Taylor, exponential, trigonometric and hyperbolic) and interpolation polynomials (Lagrange, Legendre, and Chebyshev) have been adopted in the analysis of cross-ply and angle-ply laminated structures. Partially-coupled thermal models are successfully extended to hygroscopic analyses, with which new solutions for quasi-static hygrothermal problems are proposed.

Taking advantage of the expression of kinematic models in CUF, node-dependent kinematics is proposed, which makes an efficient approach to constructing global-local. The numerical results show that compared with traditional FEM models, beam and plate models with node-dependent kinematics can reduce the computational costs greatly without losing solution accuracy. FEM models with variable ESL/LW nodal capabilities were investigated in the construction of global-local models for the analysis of laminated structures, and both plate and beam models were considered. Such a technique will be extended to shell models in the near future. In the framework of CUF, Hierarchical Legendre polynomial expansions (HLE) are adopted as shape functions of 2D p-version elements, as well as the cross-section functions of refined 1D beam models. HLE is also used in combination with node-dependent kinematics to construct computationally efficient FEM models. HLE-based 2D p-version elements are free of locking for thin plates in some cases, which will be further exploited. NDK is applied in the modeling of slender structures with piezo-patches. Thermo-piezo-elastic coupling and vibration cases were also considered.

- Attività di formazione svolta nell'anno (corsi, seminari, etc.); per ogni attività specificare natura, durata e sede
  1. Communication I    Soft    5h    PoliTO
  2. Communication II    Soft    12h    PoliTO
  3. Managing Ph. D. Thesis as a Project    Soft    8h    PoliTO
  4. Self-Management: techniques for work environment    Soft    8h    PoliTO
  5. Geometrically exact shell elements for multifield problems through sampling-surfaces formulation  
  Hard    15h    PoliTO
  6. Spring School – Computational methods of the analysis design, and failure of composites    Hard    21h  
  CISM (Udine)
  7. Workshop on Composite Manufacturing and Process Simulation    Hard    18h    University of Bristol
- Eventuale partecipazione del Dottorando ad ulteriori attività di ricerca nell'anno (progetti e convenzioni di ricerca)

1. 8th ECCOMAS Thematic Conference on Smart Structures and Materials (SMART 2017), 5-8 June 2017, Madrid, Spain.
  2. 21st International Conference on Composite Materials (ICCM21), 20-25 August, Xi'an, China.
- Eventuale partecipazione del Dottorando ad Attività interne di supporto alla didattica nell'anno (specificare su quali corsi, e se eventualmente il Dottorando sia stato nominato Cultore della Materia)
- 
- Eventuali soggiorni presso altri Centri di Ricerca nell'anno
- 
- Eventuali collaborazioni con imprese nell'anno
- 
- Elenco delle Pubblicazioni del Dottorando
    1. E. Carrera, M. Cinefra, and G. Li, Refined finite element solutions for anisotropic laminated plates. Composite Structures, 2017. In press.
    2. E. Zappino, G. Li, A. Pagani, and E. Carrera, Global-local analysis of laminated plates by node-dependent kinematic finite elements with variable ESL/LW capabilities. Composite Structures, 172, pp.1-14.
    3. E. Carrera, E. Zappino, and G. Li, Finite element models with node-dependent kinematics for analysis of beams structures. Composites Part B: Engineering (2017). In press.
    4. M. Cinefra, M. Petrolo, G. Li, and E. Carrera, Hygro-thermal analysis of multilayered composite plates by variable kinematic finite elements. Journal of Thermal Stresses, 2017. In press.
    5. M. Cinefra, M. Petrolo, G. Li, and E. Carrera, Variable kinematic shell elements for composite laminates accounting for hygro-thermal effects. Journal of Thermal Stresses, 2017. In press.
    6. E. Carrera, E. Zappino, and G. Li, Analysis of beams with piezo-patches by node-dependent kinematic FEM models. Journal of Intelligent Material Systems and Structures. Accepted.
    7. E. Zappino, E. Carrera and G. Li, Free vibration analysis of beams with piezo-patches using a one-dimensional model with node-dependent kinematics. DEMEASS VIII, 22-24 May 2017, Moscow, Russia.
    8. E. Carrera, M. Cinefra, G. Li, and E. Zappino, Node-dependent kinematic one-dimensional FEM models for the analysis of beams with piezo-patches. SMART 2017, 5-8 June 2017, Madrid, Spain.
    9. G. Li, A. G. de Miguel, A. Pagani, E. Zappino, and E. Carrera, Finite beam elements based on Legendre expansions and node-dependent kinematics for the global-local analysis of composite structures. ICCM21, 20-25 August, Xi'an, China.
    10. G. Li, A. G. de Miguel, E. Zappino, A. Pagani, and E. Carrera, Finite element models with node-dependent kinematics adopting Legendre polynomial expansions for the analysis of laminated plates. ICCM21, 20-25 August, Xi'an, China.
    11. E. Zappino, E. Carrera, and G. Li, Thermo-piezo-elastic analysis of beam structures using node-dependent kinematics one-dimensional models. AIMETA 2017, 4-7 September, Salerno, Italy.

Torino,

---

Firma del Tutore

---

Firma del Dottorando

---

Il Coordinatore

---