POLITECNICO DI TORINO
Dipartimento di Ingegneria Meccanica e Aerospaziale

AVVISO DI SEMINARIO

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terrà un seminario dal titolo

Progress in Inverse Finite Element Method for Shape- and Stress-Sensing of Shell Structures

Structural Health Management (SHM) systems are designed to mitigate accidents due to structural failures and are envisioned as integral technologies of the next-generation aerospace vehicles. Advanced sensor arrays and signal processing technologies are being developed to provide distributed, real-time sensor monitoring of states of strain, temperature, and aerodynamic pressure. When properly integrated within robust and computationally-efficient physics-based algorithms, the ensuing massive quantities of measured data will help infer physically admissible structural behavior, provide real-time feedback to the actuation and control systems, and assess internal loads and structural integrity.

This lecture will address the latest advances in the inverse Finite Element Method (iFEM), which represents a significant step toward bringing SHM closer to the realm of higher technology readiness. The iFEM enables reconstruction of full-field displacements, strains, and stresses, using measured strain data provided by in-situ strain sensors. Various applications of this computational technology have already been demonstrated for beam, frame, plate, and shell structures using numerically generated as well as experimentally measured strain data, both for linear and geometrically nonlinear deformations and small strains. Unlike most other methods for deformed shape reconstruction, iFEM is general enough to be applicable to complex geometries, boundary conditions and loadings, with and without inertial effects.

Two iFEM formulations for application to shell structures are discussed. The first formulation utilizes First-order Shear Deformation Theory (FSDT) as its analytic basis, whereas the second uses Refined Zigzag Theory (RZT). This new structural theory is well suited for laminated composite and sandwich structures. Both formulations are based upon a weighted-least-squares variational principle that uses the complete set of strains corresponding to the respective theory. The error functional uses the least-squares-difference terms comprised of the strain components that are expressed in terms of the assumed element displacements and the corresponding strains that are measured experimentally. The discretization of a complex shell structure is accomplished by way of simple and efficient three-node inverse-shell elements that are based upon C^0-continuous, anisoparametric shape functions.

Finally, the lecture will highlight several numerical examples that demonstrate the unique modeling capabilities of the latest iFEM formulations. These include problems in which measured strains are only provided along sparsely distributed lines to simulate strain data from FBG arrays. In addition, large-displacement (geometrically nonlinear) problems will be discussed in which iFEM is applied using incremental strain measurements, while updating the deformed geometry following the incremental reconstructions. Results for problems with numerically simulated and experimentally measured strains will be discussed.

Il Seminario si terrà presso l'**aula 15A** a partire dalle ore **10:00** di **giovedì 19 Gennaio**.

Tutti gli interessati sono cordialmente invitati a intervenire.

Per informazioni, contattare

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