ALL. B

SCHEDA PER LA RELAZIONE ANNUALE DEL DOTTORANDO CICLO Anno

- Nome e Cognome **S. Mehrdad Pourkiaee**
- Dottorato in **INGEGNERIA MECCANICA**
- Ciclo **XXXII** Anno di Corso **I**
- Dipartimento di afferenza **DIMEAS**
- Coordinatore **Prof. Luigi GARIBALDI**
- Tutore **Prof. Stefano Zucca**
- Area Culturale di Interesse (in Italiano e Inglese)
  Dinamica nonlineare di dischi di turbina con contatti striscianti: sviluppo di modelli ridotti.
  Nonlinear dynamics of turbine bladed disks with friction contacts: development of reduced order models
- Breve descrizione dell'argomento della tesi o dell'Area Culturale di Interesse (massimo 20 righe, in Italiano e Inglese)

  Turbine blades can be found in engines used to power aircrafts and power plants. Due to the high modal density of realistic bladed disks and to the broad frequency content of the aerodynamic excitation forces, a blade design which is resonance-free in the frequency range of interest is unfeasible. High cycle fatigue (HCF) failure of turbine and compressor blades due to resonance in the operating frequency range is one of the main problems in the design of gas turbine engines. To suppress excessive vibrations in the blades and prevent HCF, dry friction dampers are used by the engine manufacturers. However, due to the nonlinear nature of friction contacts, analysis of such systems becomes complicated. In addition to that, it has shown in the literature that the effects of small variations between blades and consequently the loss of cyclic symmetry properties, known as mistuning, could considerably affect the dynamic behavior of bladed disks in gas turbines. Compared with that of a tuned bladed disk, which is a bladed disk with identical blades, the vibration response levels of a mistuned counterpart can be much higher. Moreover, mistuning results in localization of vibration around few number of blades and finally brings HCF to the gas turbine. Extensive knowledge on mistuned bladed disks has been gained in the past decades of research, but there is still a shortfall in providing industry with adequate tools to reduce the costs related to the consequences of mistuning. Motivated by the turbomachinery community's need for practical design tools that incorporate mistuning effects, the objectives of this thesis are:
  To achieve a thorough understanding of the fundamental mechanisms governing mistuning effects
  - ❖ To develop highly efficient and accurate reduced order modeling techniques for the free and forced response of tuned and mistuned bladed disks
  - ❖ To broaden the scope of these reduced order modeling techniques for nonlinear forced response analysis of turbine blade disks with friction contacts
  - ❖ To validate the developed methods with experiments

- Attività di formazione svolta nell'anno (corsi, seminari, etc.); per ogni attività specificare natura, durata e sede
  1. Models and Methods for the Dynamics of Mechanical Components with Contact Interfaces (27h)
  2. Advanced Aspects of the Finite Element Method (20h)
  3. Stability and Bifurcations of Dynamical Systems: Theoretical Aspects and Applications (27h – Summer School – Savona, Italy)
  4. Public Speaking I (5h)
  5. Project Management (5h)
  6. Communication I (5h)
  7. Communication II (12 h)

8. Writing Scientific Papers in English (15h)

- Eventuale partecipazione del Dottorando ad ulteriori attività di ricerca nell'anno (progetti e convenzioni di ricerca)

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- 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)

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- Eventuali soggiorni presso altri Centri di Ricerca nell'anno

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- Eventuali collaborazioni con imprese nell'anno

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- Elenco delle Pubblicazioni del Dottorando

  S. Mehrdad Pourkiaee, Stefano Zucca, "**A reduced order model for mistuned bladed disks with friction contacts**", Turbo EXPO 2018, Abstract Submitted.

Torino,

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Firma del Tutore

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Firma del Dottorando

Il Coordinatore

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