ALL. B

STUDENTS' ANNUAL ACTIVITY REPORT CYCLE 34 YEAR 2

- Name and Surname **Erhan Ferhatoglu**
- Dottorato in **INGEGNERIA MECCANICA**
- Department **DIMEAS**
- Coordinator **Prof. Luca GOGLIO**
- Tutor **Prof. Stefano Zucca**
- Macroarea
  Nonlinear Vibration Analysis of Turbine Bladed Disks with Mid-Span Dampers

- Short description of research activity (maximum 20 lines)
  The main objective of the thesis is to obtain the forced response of bladed disks with friction contacts by developing reliable and accurate numerical solvers. The thesis has two different branches. The first one is an industrial application of a different type of friction dampers, Mid-Span Dampers that is used extensively in Baker Hughes Company turbines, for nonlinear vibration analysis of steam turbine Last Stage Blades. For this purpose, ad hoc numerical solvers, which utilize the coupled approach of static and dynamic equations as a first time for this type of dampers, are being developed. Besides the dynamic response of the bladed disk structure, the response variability phenomenon is also studied. The second main topic in the thesis is the detailed general investigation of variability phenomenon in turbo-machinery applications. The variability phenomenon in dry friction may result to obtain quite different dynamic response levels for the mechanical structures having contact interfaces. Hence, the existence of multiple solutions requires predicting the upper limit in terms of engineering point of view. Complying with this purpose, a novel approach for the determination of dynamic response limits among multiple solutions is studied. The effect of variability on different type of friction damping structures such as in shrouds, blade roots and wedge dampers is examined.

- Training activities carried out during the year (courses, seminars, etc.); for each activity specify the nature, duration, and location

  Numerical Modelling and Simulation (FEA) (50h)
  Short Courses on Tribology, Contact Mechanics and Dynamics at Rice University, Houston/Texas, USA
  Research Camp at Rice University, Houston/Texas, USA (30h)
  Research Integrity (5h)
  Communication I (5h)
  Public Speaking I (5h)
  Project Management (5h)
  Academic Writing (15h)

- Possible participation in further research activities during the year (research projects and agreements)

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- Possible participation in internal activities to support teaching during the year (specify on which courses, named as "subject expert")

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- Stays at other research institutions during the year

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- Collaborations with companies during the year
  Collaboration with Baker Hughes Company: "Mid-span damper applied on steam turbines last stage blades numerical characterization"

- List of accepted papers

  E. Ferhatoglu, S. Zucca, D. Botto, J. Auciello, L. Arcangeli, Nonlinear Vibration Analysis of Turbine Bladed Disks with Mid-Span Dampers, *Turbomachinery Technical Conference & Exposition,* (2020)

Date, 18/09/2020

Stefano Zucca

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Signature of Tutor

E. Ferhatoglu

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Signature of the Phd student

The Coordinator

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