

# SCHEMA PER LA RELAZIONE ANNUALE DEL DOTTORANDO

## CICLO Anno

- Nome e Cognome **ZEESHAN SAEED**
- Dottorato in **INGEGNERIA MECCANICA**
- Ciclo **33rd** Anno di Corso **1st**
- Dipartimento di appartenenza
- Coordinatore **Prof. Luca GOGLIO**
- Tutore **Prof. Teresa Berruti**  
**Prof. Christian Firrone**
- Area Culturale di Interesse (in Italiano e Inglese)

***"Numerical and Experimental Forced Response of Mistuned Bladed-disks with Friction Dampers"***

- Breve descrizione dell'argomento della tesi o dell'Area Culturale di Interesse (massimo 20 righe, in Italiano e Inglese)

*This PhD research is to focus on developing modelling techniques for the forced response analysis of single-stage bladed disks with friction damping, which can be subject to mistuning. The models must be validated through the experiments to be conducted on the test-rigs in the AER-MEC lab at the Politecnico as well as the research facilities of the institutions hosting the secondments i.e. Technical University of Munich and Middle East Technical University, Ankara. The models thus developed should be able to predict accurately the worst-case response with the use of stochastic or statistical methods.*

*The research project is funded through EXPERTISE, a European Training Network (ETN) under the European Union's Horizon 2020 research and innovation programme.*

- Attività di formazione svolta nell'anno (corsi, seminari, etc.); per ogni attività specificare natura, durata e sede

*The training activities are tabulated below:*

S. #	Course Title	Location	Lecture Hours
<b>HARD SKILLS TRAINING</b>			
1.	Nonlinear Vibrations	POLITO	30
2.	Vibration based Statistical Time Series Methods for Structural Health Monitoring	POLITO	12 *
3.	Substructuring in Engineering Dynamics; Emerging Numerical and Experimental Techniques	CISM, Udine	27
4.	An ECCOMAS Advanced Course on Computational Structural Dynamics	Technical University of Prague	24
5.	Measurement Technology	DTSquare, Stuttgart	24
6.	EXPERTISE Kick off Training - advanced modeling of friction contacts - identification techniques	Technical University of Munich	16
7.	Nonlinear Dynamics of Coupled Structures and Interfaces - Summer School 2018	Imperial College, London	6
<b>Total Hard Skills Hours Obtained</b>			<b>97</b>
<b>Total Hours Anticipated</b>			<b>109 *</b>
<b>SOFT SKILLS TRAINING</b>			



8.	Communication	POLITO	5
9.	Entrepreneurial Finance	POLITO	5
10.	Project Management	POLITO	5
11.	Public Speaking	POLITO	5
12.	Writing Scientific Papers in English	POLITO	15
13.	Responsible research and innovation, the impact on social challenges	POLITO	5 *
14.	Time Management	POLITO	2 *
		<b>Total Soft Skills Hours Obtained</b>	<b>35</b>
		<i>Total Hours Anticipated</i>	<i>42 *</i>

\* Yet to be updated / credited

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

As part of the EXPERTISE project's mandate, I participated in a group project aimed at developing a real test-case demonstrator for the project that can be used for testing and benchmarking the new dynamic methods including friction and wear.

- 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

*Nonlinear Dynamics of Coupled Structures and Interfaces, Imperial College London (4th July – 10th August):*

*Worked in a group project to implement continuation methods for the bladed-disks with friction contacts.*

*The nature of the work was numerical and required:*

- *Geometric modelling and meshing*
- *Building the system matrices including the pre-stress effects*
- *Model order reduction by Craig-Bampton method*
- *Multi-harmonic balance method with different continuation schemes*
- *Developing 3D friction element with analytical Jacobian*

- Eventuali collaborazioni con imprese nell'anno
- Elenco delle Pubblicazioni del Dottorando

**Anticipated Publications from onsite and offsite research activities:**

1. RASD 2019: **"SUBSTRUCTURING FOR MISTUNING IDENTIFICATION AT THE BLADE ROOT JOINTS"**
2. IMAC 2019: **"A TEST-CASE ON CONTINUATION METHODS FOR BLADED-DISK VIBRATION WITH CONTACT AND FRICTION"**

01/10/2018

Torino,

T. M. B. L.  
Firma del Tutore

[Signature]  
Firma del Dottorando

Il Coordinatore