Elenco dei corsi, e relativi programmi, della Scuola di dottorato per l'A. A. 2019-2020 (18 corsi):

- Prof. Michele NAPOLITANO, relativamente all'insegnamento "How to write a technical paper and to present it effectively to an educated audience"; (3 CFU, L-LIN/12; TR)
The course will provide a review of English grammar and the essentials of good writing. It will describe what belongs to the Abstract, the Introduction, the Method, the Results, the Discussion, Future work, Acknowledgments and References. The course will also cover selected topics on the science of scientific writing and of the textbook "Academic Vocabulary in Use" (Cambridge University Press). Moreover, the course will provide the basic rules for preparing a clear and effective Power Point presentation. Finally, each student will submit (a part of) a paper to the attention of the class for collegiate analysis and discussion, so as to render it more effective and pleasant to read; and will present it to the class using power-point, so as to become an interesting and appealing speaker.

- Prof. Nicola MENGA, relativamente all'insegnamento "Fundamentals of surface roughness analysis for tribology"; (3 CFU, ING-IND/13; TR)
Introduction to probability

1. 1.1. Random variables and countable sets
2. 1.2. Events and probability
3. 1.3. Dependence, independence, and conditional probability

Introduction to the surface roughness as a stochastic process

1. 2.1. Stationary and non-stationary processes
2. 2.2. Ergodicity of real rough surfaces

Probability density function (PDF) in surface roughness analysis

1. 3.1. Amplitude Probability Distribution and Density Functions
2. 3.2. Surface height distribution functions
3. 3.3. Probability Distribution and Statistics of the Asperities and Valleys

Correlation function and correlation length in stochastic processes

Spectral analysis of rough surfaces

1. 5.1. Fourier Transform and Power spectral density (PSD)
2. 5.2. Momentum of the PSD and statistical parameters of rough surfaces

Introduction to statistics for contact mechanics

1. 6.1. Multi-asperity theories
2. 6.2. Persson's theory

- Dott. Giuseppe DINARDO, relativamente all'insegnamento "Optical measurements in fludynamics"; (3 CFU, ING-IND/12; TR)
a) Laser doppler velocimetry (1,25 cfu) i) Different optical models for LDA (1) Reference beam system
(2) Fringe model
ii) Signal processing

iii) Potential of LDA
iv) Multi directional measurements
v) Direction sensing
vi) Measurements of large velocity fluctuation vii) Application to flow measurements
viii) Alternative Laser Velocimetry techniques b) Particle Image Velocymetry (PIV) (1 cfu) i) Principle of the technique
ii) Image recording
iii) Image processing
iv) Solving directional ambiguity v) 3D techniques
vi) Examples of applications
c) Laboratory activities (0,5 cfu)

- Prof. Vincenzo MORAMARCO, relativamente all'insegnamento "Residual stress evaluation by X-ray diffractometry"; (2 CFU, ING-IND/14; TG)

1. Introduction
2. Principles
3. Measurement of Lattice Strain
4. Analysis of Regular $d\varphi\psi$ vs. $\sin 2\psi$
5. Calculation of the stress
6. Effect of the Sample microstructure
7. Apparatus
8. XRD Depth Profiling Using Successive Material Removal
9. Measurement Procedure
10. Examples and practical consideration 11. Laboratory

- Prof.ssa Claudia BARILE, relativamente all'insegnamento "Advanced opto-acoustics methods for experimental mechanics"; (2CFU, ING-IND/14; TR)

The aim of the course is to provide knowledge and competencies in applying advanced both optical and/or acoustic techniques for an innovative approach to mechanical characterize materials in the experimental mechanics. The course will be split in two branches referring to the two methodologies in object.
Ten hours will be devoted to the optical approach: 6 for theory and 4 for laboratories. They will focus on the main characteristics of the geometrical optics and its properties according to the Fraunhofer's approximation, an overview on lens distortions and calibration methods, and the application for the correlation of the images: 2D, 3D and volumetric. During the laboratory the students will experience a real measurement for evaluating the displacement field of a component by using the Digital Image Correlation equipment.
Ten hours will be devoted to the acoustic approach: 6 for theory and 4 for laboratories. They will focus on the origin of acoustic emissions in materials, the main features of stress waves produced by materials, description of the equipment for acoustic emission, and the analysis techniques of acoustic emissions. During the laboratory the students will experience a real evaluation of the wave sound speed for different materials and on the proper location of defects.

- Prof.ssa Ilaria Filomena GIANNOCCARO, relativamente all'insegnamento "Collective and swarm intelligence"; (3CFU, ING-IND/35; TR)
- Origin and definition
- Building blocks
- Drivers
- The effect of distrust on the emergence of collective intelligence - Statistical physics of decision

making
- Discrete and continuous models
- Phase Transition, Criticality and the Emergence of Swarm intelligence
- Prof. Giuseppe CASALINO, relativamente all'insegnamento "Design of experiment for research and process optimization" (3 CFU, ING-IND/16; TR)

This course covers the statistical design of experiments for systematically examining systems function. Topics covered will include: refresh of basic principles of Statistical inference, introduction to experiments, completely randomized designs, blocking designs, full factorial designs with two levels, fractional designs with two levels and response surface designs.
The goal of the course is to transmit to students the basic skill to design and conduct experiments, as well as to optimize engineering system through analysis and interpretation of experimental data.

- Prof. Giuseppe PIRO, relativamente all'insegnamento "Emerging methodologies and technologies for the Cyber Security"; (3CFU, INF/03; TR)

Perimeter Security
Secure network architectures, De-Militarized Zone (DMZ), Bastion host Network-layer and application-layer firewalls, Next Generation Firewall (NGFW) Intrusion Detection Systems and Intrusion Prevention Systems

Emerging encryption, authorization, and authentication mechanisms

OAuth 2.0 framework

Access control mechanisms based on IBAC, RBAC, and ABAC

Attribute Based Encryption (ABE) and its extensions

Suitable mechanisms for distributed and multi-authority environments (i.e.,

symbIoTe security

framework, DMA-CP-ABE)

Security approaches for Cyber-Physical Systems (CPS) and cloud-based CPS

Lightweight cryptography and key management scheme for the Internet of Things Elliptic Curve Qu-Vanstone (ECQV) algorithm and Implicit X.509 certificates Blockchain technology, applications, and emerging platforms

Experimental configuration of advanced security solutions

Defined in agreement with interested students

- Prof. Silvano VERGURA, relativamente all'insegnamento "Supervision and monitoring of renewable energy systems"; (3 CFU, ING-IND/31; TR)

The course aims to introduce the fundamental concepts for the monitoring of the electrical and energy performance of plants/systems based on Renewable Energy Sources (RES), notably photovoltaic systems, and for the diagnostics of anomalies or failures. The first part will be based on the statistical methods applied to the usually available data, the second one will based on the non-destructive diagnostic techniques, in particular on the infrared analysis.

- Prof. Francesco DELL'OLIO, relativamente all'insegnamento "Lab-on-chip devices"; (3 CFU, ING-INF/01, TR)

- General introduction to Lab-on-chip devices.

- Overview of biochemical assays and sequencing techniques.

- Introduction to microfluidics.

- Materials and fabrication techniques for integrated microsystems. - Electrochemical and photonic techniques for detection

- LoC Applications.

- Prof. Nicola GIAQUINTO, relativamente all'insegnamento "Matlab Recipes for Measurement Data Processing"; (3 CFU, ING-INF/07; TR)

In accordance with the principles stated in the summary, the programme is subject to be adjusted. Below is a list of possible opics of interest

Introduction: TOMFL (Test of Matlab as a Foreign Language)
Fundamentals and applications of linear and nonlinear Least Squares Method. Repeatability and uncertainty of measurements.
How good is my data acquisition hardware? Measuring ENOB, integral and differential nonlinearity, amplitude noise, time noise.
Advanced use of my arbitrary function generator: syntesizing and using a "good" test signal.

- Prof. Francesco FIORITO, relativamente all'insegnamento "Adaptive technologies tor the Mitigation of Urban Heat Island and Climate Change Effects"; (3 CFU, ICAR/10; TR/DV)

The first part of the course will explore in details the major issues of urban climatology, helping in defining the interaction between environmental variables, outdoor surfaces and building fabrics. In the second part of the course detailed students will investigate in detail adaptive technologies to mitigate the temperature effects of climate change-related phenomena. Examples from successful real case studies will be shown. Finally, the third part of the course will provide students with a hands-on experience of modelling techniques and tools to simulate the thermal characteristics of cities and buildings and assess the impact of adaptation technologies. The assessment will be based on the modelling of a selected case study and on the analysis of the effects of different adaptation technologies.

- Prof. Francesco PORCO, relativamente all'insegnamento "Advanced numerical modelling and nonlinear analysis of existing buildings under seismic actions". (3 CFU, ICAR/09)

1. Introduction to advanced computational and numerical methods for the nonlinear structural analysis. The basics elements and references for the Fem analysis will be provided, and additionally an overview about alternative computational approaches will be given: Finite Element Methods, Distinct Element Methods, Rigid Body and Spring Methods. The course will be then specifically focused about the modelling and analysis in the nonlinear dynamic field, time-history analysis; issues and approaches in the selection of the seismic input; use of nonlinear static approaches, with specific regard to multi-modal and adaptive pushover analysis.

2. Methods and strategies for the structural and seismic analysis of existing buildings accounting for structural and nonstructural elements
The modelling; and analysis peculiarities of existing buildings will be provided, with a focus on the influence of nonstructural elements on the structural response and on the possible strategies and computational approaches to be used,

3. Presentation of real case studies with the use of specialized software.
The course will provide a short exercise developed by the PhD student on a theme chosen according to his/her specific interests of research
Motivation. This the course represents a fundamental basis for all doctoral students dealing with complex engineering problems, in the spirit of the program of the Ph.D. in Risk and Environmental, Territorial and Building Development, but involves also a number of interdisciplinary themes interesting in other engineering fields, such as, for example: development, design and testing of mechanical devices for passive and active seismic protection; processing of signals to be used as an input; treatment of large dataset data deriving from numerical vulnerability analyses.

- Dott.ssa Diana DE PADOVA, relativamente all'insegnamento "Lab-and-field data acquisition and processes in Hydraulics". (3 CFU, ICAR/01; TR)

The following topics are studied, combining theory and practical examples.
Measurement definition and concept. Measurement instrumentation and sensors. Sources of error. Measurement uncertainty.
Measurement in static and dynamic conditions.
Instrument calibration. How to get a calibration curve from laboratory data.
Sensitivity, accuracy and precision. Measurement range and frequency response. Instrument precision. Measurement error. Theory of errors.

How to carry out a measurement. Nyquist theorem. Sampling duration.
Signal analysis in time and frequency domain. FFT and IFFT. How to obtain a spectrum of the measured signal with FFT technique.
Acquisition signal chain. Control and management of remote measuring stations, with sensors sampling hydrodynamic parameters.
Acoustic and laser signal sources. Doppler effect. Measuring flow velocity with LDA and ADV sensors.

Prof. Pietro CAMARDA, relativamente all'insegnamento "Theory and applications of stochastic processes"; (3 CFU; ING-INF/03; TR).

Review of probability (2 hours)

Poisson Processes (4 hours)

Finite State Markov Chains (4 hours)

Countable State Markov Chains (2 hours)

Continuous Time Markov Chains (4 hours)

Introduction to queueing and queueing network theory (4 hours) Selected Applications (4 hours)

- Ing. Sergio BRUNO, relativamente all'insegnamento "Design and optimization of nearly zero energy buildings and districts"; (3 CFU; ING-IND/33; TR).

Introduction
Technologies for Zero Energy Buildings and Districts
Modelling principal components
Development of tools for optimal operation of ZEB/ZED
Representation of most common distribution grids: electrical, natural gas and water Optimization of energy resources in the presence of grid constraints
Development of tool for optimal design of ZEB/ZED

- Prof. Salvatore DIGIESI, relativamente all'insegnamento "Human performance in production systems"; (3 CFU; ING-IND/17; TR).

Industry 4.0, Internet of Things and Lifecycle Management.
Ergonomic principles in the workplace.
Work-related Musculoskeletal Disorders (MSDs) and upper limbs movements and postures. OCRA method and International Standards (ISO).
Real time ergonomic assessment using low cost sensors.
Human Performance and Human Factors.
Definition of Human Reliability.
Reliability-based Human Performance: Models and Tools Human Factors and 'Industry 4.0'.
Human Performance in visual inspection and operation tasks in assembly line.
Human Performance Modeling.
Learning Fatigue Phenomena in Operations.
Risk Analysis in Industrial Plants Vigilance tasks in safety functions.

Stefan Suhr, Tensor Calculus for Engineers and Smooth Manifolds (2 CFU)

Review of finite dimensional vector spaces : bases ; scalar products ; orthonormal bases ; linear forms, dual vector spaces ; dual bases ; topology (4h). Multilinear algebra : tensors algebra of a vector space ; index notations ; covariant and contravariant tensors ; changes of basis ; exterior product ; symmetric and skew-symmetric tensors ; p-forms (6h). Tensor analysis on Euclidean spaces : maps and tensor field ; differentiability of a map ; gradient of a scalar field ; coordinates ; change of coordinates, examples. Covariant derivative. Differential forms and integration (6h). Manifolds : definition of topological and smooth manifolds ; coordinates ; curves ; tangent space at a point ; tangent and cotangent bundle ; surfaces ; vector fields ; tensor fields. Riemannian metrics (8h).