



POLITECNICO
MILANO 1863

DIPARTIMENTO DI MECCANICA

Non-destructive tests

Experimental and simulation means for non destructive testing and structural health monitoring

Description:

Research and applicative activities on non-destructive testing and structural health monitoring of structural materials and components are performed both experimentally and numerically. Traditional and advanced techniques are applied, while innovative ones are developed. In-service monitoring and prognostics are studied and applied, as well

Certified NDT personnel:

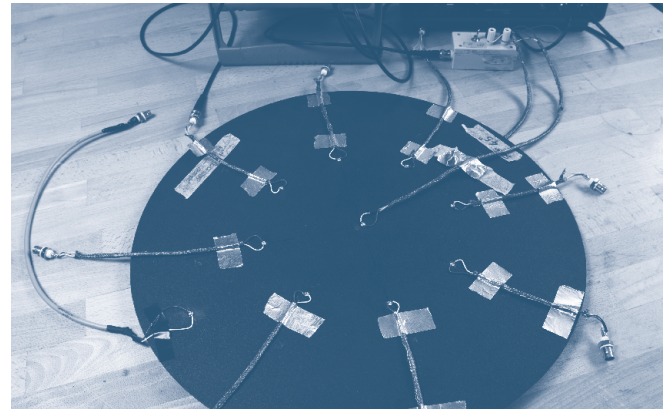
- Level 2 and 3 Liquid Penetrant Testing (PT) according to ISO 9712
- Level 2 and 3 Magnetic Particles Testing (MT) according to ISO 9712 and including the extension for Railway Maintenance according to the Italian Regulation
- Level 2 and 3 Ultrasonic Testing (UT) according to ISO 9712 and including the extension for Railway Maintenance according to the Italian Regulation
- Level 2 and 3 Visual Testing (VT) according to ISO 9712 and including the extension for Railway Maintenance according to the Italian Regulation

Tests accredited according to ISO 17025:

Liquid penetrants testing

References:

ALSTOM Ferroviaria S.p.A., AnsaldoBreda S.p.A., ATM S.p.A., Autostrade per l'Italia S.p.A., Brembo S.p.A., CIFA S.p.A., Cromodora Wheels S.p.A., Deutsche Bahn AG, ENI S.p.A., GE Avio S.r.l., Hitachi Rail S.p.A., ITA S.p.A., Italcertifer S.p.A., ITER Organization, Lop-tex S.r.l., Lucchini RS S.p.A., Pojazdy Szynowe Pesa Bydgoszcz SA, Radici Novacips S.p.A., RFI S.p.A., SAIPEM S.p.A., Siemens S.p.A., Spasciani S.p.A., Tenaris/Dalmine S.p.A., Titagarh Firema S.p.A.



Instruments & Facilities:

- Harfang X32 phased array ultrasonic flaw detector with 2.25, 5 and 10 MHz probes. Encoders for C-Scan mapping
- Eddyfy M2M Mantis phased array ultrasonic flaw detector with 2.25 and 5 MHz probes. TOFD, conventional ultrasonic channels and TFM functionalities are available, as well
- RDG500 and RDG2500 conventional ultrasonic flaw detectors with straight, twin, angled and creeping probes
- Innerspec Temate Powerbox H EMAT ultrasonic flaw detector with permanent magnets and coils for different beam forming opportunities
- Specific equipment for implementing and managing Lamb and guided ultrasonic waves
- Vallen AMSY-6 acoustic emission unit (8-channels). Managed by the PoliNDT interdepartmental lab
- Nortec 1000S+ eddy current flaw detector with probes working at a 500-2000 Hz frequency range
- NSI X25 x-ray micro-computed tomography scanner. Managed by the AMALA interdepartmental lab
- Electromagnetic yokes and permanent magnets for colour contrast and fluorescent magnetic particles (calibration blocks, luxmeter, radiometer, UV lights, ASME probe, gaussmeter)
- Colour contrast and fluorescent liquid penetrants (calibration blocks, luxmeter, radiometer, UV lights, thermocouples, chronometer)
- Lenses, mirrors and dedicated white and black lights for visual testing
- CIVAnde specific software package for NDT simulations (ultrasonic testing, eddy current testing, radiographic testing and x-ray computed tomography)
- AST X-Stress 3000 portable X-ray diffractometer
- Equipment for holographic interferometry and for transmission and reflection photo-elasticity

Activities:

Experimental and numerical characterization of NDT capabilities:

- Characterization of experimental "Probability of Detection" curves for different NDT methods
 - Characterization of numerical "Model Assisted Probability of Detection" and "Multi-Parameter Probability of Detection" curves for different NDT methods
 - Interaction between NDT capabilities and the damage tolerant design approach
- Traditional and advanced ultrasonic testing of materials and components:
- Phased array monitoring of fatigue crack propagation in adhesive bonded composite lap-joints
 - TOFD inspection of welded and seamless metallic pipes
 - Guided waves monitoring of pipes and rails
 - Residual stress measurements in railway wheels by EMAT
 - Application of creeping waves to coarse grain metals

Structural health monitoring by ultrasonic Lamb waves:

- Determination and characterization of dispersion curves in metallic,

composite and polymeric components

- Definition of an innovative way to induce a single anti-symmetric propagation mode of Lamb waves
- Analysis of the reflection and transmission of Lamb waves through artificial delaminations in composite laminates
- Analysis of the reflection and transmission of Lamb waves through natural defects, obtained by low energy impacts, in composite laminates

Structural health monitoring by acoustic emission:

- In-service monitoring of railway axles by means of acoustic emission
- In-service monitoring of adhesive bonded joints by means of acoustic emission
- Comparison of acoustic emission response with optical, micro-computed tomography scans and ultrasonic NDT approaches during crack propagation tests
- Comparison of acoustic emission response with low frequency vibrations during crack propagation tests
- Post-processing and interpretation of acoustic emission data by machine learning and artificial intelligence

Eddy current testing of corrosion-fatigue phenomena:

- Experimental eddy current measurements of developing corrosion-fatigue damage in small-scale specimens and full-scale components
- Correlation between damage and eddy current response at different stages of corrosion-fatigue life
- Numerical simulations of eddy current response at different stages of corrosion-fatigue life

