

# Sensors & NDT/ NDE

In today's rapidly advancing technological landscape, Non-Destructive Testing (NDT) has become indispensable across various industries, including aerospace, manufacturing, construction, and the oil and gas sector. EMWorks stands at the forefront of NDT technology, revolutionizing the way these crucial inspection techniques are designed, tested, and optimized.

NDT methods play a pivotal role in ensuring the integrity and safety of critical components and structures across diverse sectors. In aerospace, NDT is essential for inspecting vital aircraft components, while in manufacturing, it guarantees product quality. In construction, NDT ensures the safety and reliability of buildings and infrastructure, and in the oil and gas industry, it plays a key role in maintaining the integrity of pipelines, storage tanks, and other critical equipment.

At EMWorks, we pave the way in NDT innovation with our cutting-edge electromagnetic simulation tools. These tools empower engineers to create highly precise and reliable inspection systems. These systems are essential for detecting flaws, defects, and structural issues in a wide range of applications, including those critical to the oil and gas sector.

## Elevating NDT Technology

In today's ever-advancing technological landscape, Non-Destructive Testing (NDT) holds a significant place, serving numerous applications across diverse industries. From aerospace manufacturing to infrastructure development, NDT plays a crucial role. At EMWorks, we are dedicated to NDT innovation, providing engineers with solutions that refine NDT system design and performance.

- **Precision Inspection System Design**

EMWorks assists in precision NDT system design, offering engineers a high degree of precision for tailoring inspection systems to various applications. Whether for aerospace components, industrial manufacturing, structural inspections, or the critical realm of oil and gas pipe inspection, EMWorks equips engineers with the necessary tools to fine-tune NDT configurations, ensuring inspections are both accurate and reliable.

- **Electromagnetic Field Simulation**

The cornerstone of NDT excellence rests on understanding and optimizing electromagnetic field interactions. EMWorks provides engineers with simulation tools to visualize and meticulously optimize these interactions. This approach results in NDT systems characterized by sensitivity and precision, contributing to industry standards.

- **Aerospace Inspection**

EMWorks contributes to NDT in the aerospace industry, aiding in the development of advanced inspection systems crucial for ensuring the safety and performance of aircraft components.

- **Manufacturing Quality Control**

NDT plays a vital role in manufacturing, ensuring product quality and defect prevention. EMWorks optimizes NDT system performance to enhance efficiency and reliability in manufacturing processes.

- **Infrastructure Safety**

In construction and civil engineering, NDT is essential for guaranteeing the safety and integrity of buildings and infrastructure. EMWorks assists in the design of inspection systems capable of withstanding diverse conditions and providing precise data for infrastructure applications.

## **NDT Techniques that use Magnetism**

Within the realm of Non-Destructive Testing (NDT), various techniques are employed to inspect materials and structures for flaws and defects without causing damage. EMWorks specializes in NDT techniques that utilize magnetism, offering cutting-edge solutions for a range of critical applications. These magnetic NDT techniques include:

### **Magnetic Particle Testing (MT)**

- Magnetic Particle Testing, often abbreviated as MT, is a widely used NDT technique. It's particularly effective for detecting surface and near-surface defects in ferromagnetic materials.
- The process involves magnetizing the material under inspection using a magnetic field. Then, fine magnetic particles (usually iron filings) are applied to the surface.
- These magnetic particles are attracted to areas with magnetic flux leakage, indicating the presence of defects like cracks or discontinuities.
- MT is commonly used in industries such as aerospace, automotive, and manufacturing for its ability to quickly reveal flaws in materials, making it a cost-effective inspection method.

### **Eddy Current Testing (ET)**

- Eddy Current Testing, or ET, is a versatile NDT method that relies on the induction of eddy currents in conductive materials.
- A coil carrying an alternating current is placed near the material being inspected. Eddy currents are induced in the material, which in turn generate their own magnetic fields.

- Variations in the eddy currents are detected and analyzed to identify surface and subsurface defects, measure material thickness, and assess the conductivity of materials.
- ET is widely used in the aerospace, automotive, and manufacturing industries for inspecting critical components like aircraft engine parts and automotive brake components.

## **Magnetic Flux Leakage (MFL)**

- Magnetic Flux Leakage (MFL) is a specialized NDT technique primarily used for inspecting pipelines, storage tanks, and other ferromagnetic structures.
- In MFL, a magnetic field is applied to the material under inspection, magnetizing it.
- Any discontinuities or defects in the material, such as corrosion or cracks, disrupt the magnetic field, causing leakage.
- Sensors are used to detect these disruptions, allowing for the precise identification and measurement of defects.
- MFL is vital in the oil and gas industry for inspecting pipelines, ensuring their structural integrity and preventing leaks.

## **Remote Field Testing (RFT)**

- Remote Field Testing (RFT) is an extension of eddy current testing, designed for inspecting ferromagnetic tubing or pipes, particularly in situations where access is limited.
- It is highly effective at detecting defects in heat exchanger tubes, boiler tubes, and other components that are challenging to access directly.
- RFT employs specialized probes that generate remote field eddy currents, allowing for the assessment of wall thickness and the detection of flaws.
- This technique is crucial in industries like power generation, where the integrity of heat exchanger tubes is essential for efficient operations.

## **Alternating Current Field Measurement (ACFM)**

- Alternating Current Field Measurement (ACFM) is a precise NDT technique used to detect and size surface-breaking cracks and defects in conductive materials.
- ACFM utilizes alternating current to induce eddy currents in the material being inspected, and a probe measures the resulting magnetic fields.
- It is highly sensitive and capable of providing accurate defect sizing information, making it valuable for applications where precision is crucial, such as offshore oil and gas infrastructure inspections.

### **Pulsed Eddy Current Testing (PECT)**

- Pulsed Eddy Current Testing (PECT) is employed for assessing the thickness and integrity of metallic components, such as pipes, storage tanks, and pressure vessels.
- This technique utilizes pulsed eddy currents, where short-duration electromagnetic pulses are used to induce eddy currents in the material.
- PECT is particularly useful for corrosion assessment, as it can penetrate through non-conductive coatings to inspect the underlying metal, making it vital in industries like oil and gas for asset integrity management.

These NDT techniques provide invaluable tools for inspecting materials, ensuring safety, and maintaining the integrity of critical components across various industries. Their precise and non-destructive nature makes them essential for quality control and defect detection in modern applications.

## **Use Cases in NDT Empowered by EMWorks**

Non-Destructive Testing (NDT) methods have permeated numerous industries and applications, enabling the non-invasive detection and assessment of flaws and defects. Within this landscape, EMWorks stands as a beacon of innovation, equipping engineers with state-of-the-art simulation tools and solutions. Together, these resources amplify NDT performance and reliability across a spectrum of applications. Let's delve into these use cases where EMWorks plays a role.

### **Magnetic Particle Testing (MT)**

- **Aerospace Industry:** In the aerospace sector, where safety is paramount, MT ensures the reliability of critical engine components. By meticulously inspecting materials like steel, MT detects surface cracks and defects that could jeopardize aircraft performance. EMWorks aids engineers in optimizing MT techniques, contributing to the continued safe operation of aircraft worldwide.

- **Automotive Manufacturing:** The automotive industry relies on MT for rigorous quality control. Components like crankshafts and axles undergo inspection to meet stringent safety and performance standards. EMWorks' advanced simulation tools enhance the precision of MT, resulting in higher-quality vehicles that consumers can trust.
- **Structural Inspections:** Beyond aviation and automotive, MT finds application in civil engineering. It becomes instrumental in evaluating the structural integrity of metal elements within bridges and buildings.

## **Eddy Current Testing (ET)**

- **Aerospace Industry:** In aerospace, where aircraft skin integrity is vital, ET plays a crucial role. It can detect corrosion and other surface anomalies that could compromise aircraft structural reliability. EMWorks empowers aerospace engineers to optimize ET methods, ensuring early detection and contributing to safer and more reliable flights.
- **Automotive Manufacturing:** ET's utility extends beyond aviation into the automotive sector. Here, it detects surface cracks and measures the thickness of non-ferrous components, such as aluminum and titanium. EMWorks' solutions enhance the precision of ET in automotive applications, guaranteeing the quality and durability of essential automotive parts.
- **Quality Control:** Industries involved in the production of electrical wires and printed circuit boards (PCBs) rely on ET for quality control. It verifies the quality of non-ferrous materials, ensuring compliance with specifications and the reliable functioning of electronic components. EMWorks supports these industries by fine-tuning ET techniques for optimal quality assurance.

## **Magnetic Flux Leakage (MFL)**

- **Oil and Gas Pipelines:** In the oil and gas industry, where pipeline integrity is paramount, MFL is a critical technique. It meticulously inspects the vast network of underground and underwater pipelines, identifying corrosion, cracks, and leaks that could result in environmental harm and safety risks. EMWorks' advanced simulation tools contribute to precise MFL inspections, maintaining the integrity of these vital pipelines.
- **Storage Tanks:** Large storage tanks in the petrochemical industry rely on MFL inspections to assess their condition. By detecting issues like corrosion and thinning tank walls, MFL helps prevent leaks and structural failures that could lead to costly environmental cleanup and operational downtime.

## **Remote Field Testing (RFT)**

- **Heat Exchanger Inspection:** Power plants and refineries rely on RFT to assess the condition of heat exchanger tubes. Early detection of defects maximizes operational efficiency and minimizes unexpected shutdowns.
- **Boiler Tubes:** Industrial boilers are exposed to extreme heat and pressure. RFT plays a crucial role in ensuring the integrity of boiler tubes, preventing catastrophic failures that could compromise safety and productivity.

## **Alternating Current Field Measurement (ACFM)**

- **Offshore Oil Platforms:** ACFM is indispensable for inspecting underwater structures and pipelines in the challenging offshore environment. It identifies and sizes surface-breaking defects without the need for removal or excavation, ensuring the safety and longevity of offshore assets.
- **Subsea Pipelines:** Subsea pipelines are vital for the transportation of oil and gas. ACFM inspections are crucial for detecting and assessing corrosion, ensuring the integrity of these pipelines and preventing costly leaks.

## **Pulsed Eddy Current Testing (PECT)**

- **Oil and Gas Industry:** PECT is widely utilized in the oil and gas sector to evaluate the thickness of non-ferrous coatings on pipelines. It also detects corrosion under insulation, helping prevent leaks and structural damage.
- **Industrial Storage Tanks:** In industrial settings, storage tanks are susceptible to corrosion. PECT inspects tank bottoms and evaluates corrosion under insulation, facilitating timely maintenance and extending the service life of these essential assets.

## **Conclusion**

In the dynamic realm of technology, Non-Destructive Testing (NDT) stands as a crucial pillar, upholding safety and dependability across a spectrum of industries. This in-depth exploration unveils the multifaceted applications and cutting-edge techniques that render NDT an indispensable asset. Spanning across aerospace, automotive, construction, and the oil and gas sector, NDT techniques consistently advance, buoyed by pioneering solutions and state-of-the-art simulation tools, including those developed by EMWorks. As we journey through the landscape of NDT, its resounding impact resonates throughout numerous sectors, steadfastly safeguarding the integrity of vital components and structures. Fueled by a commitment to excellence and unceasing innovation, NDT remains at the forefront, charting the course towards industries that are safer, more reliable, and at the cutting edge of technology.