DOWNLOAD PDF EDDY CURRENT TESTING

Chapter 1 : Eddy Current Testing Archives - NDT

Eddy-current testing (also commonly seen as eddy current testing and ECT) is one of many electromagnetic testing methods used in nondestructive testing (NDT) making use of electromagnetic induction to detect and characterize surface and sub-surface flaws in conductive materials.

Trucking Eddy Current Inspection Eddy Current Testing is an electromagnetic technique used on conductive materials to detect a number of conditions, including sub-surface defects, variations in material structure, thickness and corrosion. When an energized coil is brought near to the surface of a metal component, eddy currents are induced into the specimen. These currents create a magnetic field that tends to oppose the original magnetic field. Sub-surface defects will distort the eddy currents and alter the opposing magnetic field. By measuring how the impedance of the coil in close proximity to the specimen is affected by variations in the magnetic field, a skilled operator can precisely locate and classify sub-surface defects. Eddy Current Inspection is a non-contact procedure that is unaffected by the presence of oils, paints and coatings on the test specimen. This greatly reduces preparation time prior to inspection. Frequently used for on-site inspection for corrosion in heat exchangers tubes, eddy current testing is very fast â€" making it ideal for high volume sorting of small parts for flaws, size variations and material anomalies. The Versatility of Eddy Current Inspection Eddy Current Inspection is used in a variety of industries to find defects and make measurements. One of the primary uses of eddy current testing is for defect detection when the nature of the defect is well understood. In general, the technique is used to inspect a relatively small area and the probe design and test parameters must be established with a good understanding of the flaw that is to be detected. Since eddy currents tend to concentrate at the surface of a material, they can only be used to detect surface and near surface defects. In thin materials such as tubing and sheet stock, eddy currents can be used to measure the thickness of the material. This makes eddy current a useful tool for detecting corrosion damage and other damage that causes a thinning of the material. The technique is used to make corrosion thinning measurements on aircraft skins and in the walls of tubing used in assemblies such as heat exchangers. Eddy Current Testing is also used to measure the thickness of paints and other coatings. Eddy currents are also affected by the electrical conductivity and magnetic permeability of materials. Therefore, eddy current measurements can be used to sort materials and to tell if a material has seen high temperatures or been heat treated, which changes the conductivity of some materials. One of the major advantages of eddy current as an NDT tool is the variety of inspections and measurements that can be performed. In the proper circumstances, Eddy Current Testing can be used for:

Chapter 2 : Non Destructive Testing - Eddy Current testing, (Wirbelstrom)

Eddy current testing is widely used in the aerospace industry and in other manufacturing and service environments that require inspection of thin metal for potential safety-related or quality-related problems.

Galileo Azul, , P. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license http: This article has been cited by other articles in PMC. Abstract Non-destructive techniques are used widely in the metal industry in order to control the quality of materials. Eddy current testing is one of the most extensively used non-destructive techniques for inspecting electrically conductive materials at very high speeds that does not require any contact between the test piece and the sensor. This paper includes an overview of the fundamentals and main variables of eddy current testing. It also describes the state-of-the-art sensors and modern techniques such as multi-frequency and pulsed systems. Recent advances in complex models towards solving crack-sensor interaction, developments in instrumentation due to advances in electronic devices, and the evolution of data processing suggest that eddy current testing systems will be increasingly used in the future. Introduction Non-destructive techniques are used in the metal industry and science in order to evaluate the properties of a wide variety of materials without causing damage. Some of the most common non-destructive techniques are electromagnetic, ultrasonic and liquid penetrant testing. One of the conventional electromagnetic methods utilized for the inspection of conductive materials such as copper, aluminum or steel is eddy current non-destructive testing [1]. Electromagnetic methods such as eddy current, magnetic particle or radiographic and ultrasonic methods all introduce electromagnetic or sound waves into the inspected material in order to extract its properties. Penetrant liquid techniques can detect cracks in the test material by using either fluorescent or non-fluorescent dyes. In addition to these methods, scientists such as Shujuan et al. The principle of the eddy current technique is based on the interaction between a magnetic field source and the test material. This interaction induces eddy currents in the test piece [1]. Scientists can detect the presence of very small cracks by monitoring changes in the eddy current flow [5]. Eddy current testing is especially fast at automatically inspecting semi-finished products such as wires, bars, tubes or profiles in production lines. The results of eddy current testing are practically instantaneous, whereas other techniques such as liquid penetrant testing or optical inspection require time-consuming procedures that make it impossible [8], even if desired, to inspect all production. Eddy current testing permits crack detection in a large variety of conductive materials, either ferromagnetic or non-ferromagnetic, whereas other non-destructive techniques such as the magnetic particle method are limited to ferromagnetic metals. Another advantage of the eddy current method over other techniques is that inspection can be implemented without any direct physical contact between the sensor and the inspected piece. In addition, a wide variety of inspections and measurements may be performed with the eddy current methods that are beyond the scope of other techniques. Measurements of non-conductive coating thickness [9] and conductivity can be done. Conductivity is related to the composition and heat treatment of the test material. Therefore, the eddy current method can also be used to distinguish between pure materials and alloy compositions and to determine the hardness of test pieces after heat treatments [8]. Since the s the role of eddy current testing has developed increasingly in the testing of materials, especially in the aircraft [10] and nuclear industries [11]. The extensive research and development in highly sensitive eddy current sensors and instruments over the last sixty years indicates that eddy current testing is currently a widely used inspection technique. This paper presents the basis of non-destructive eddy current testing and provides an overview of the research conducted by many authors who continue to develop this technique. The fundamentals of eddy current inspection and the main variables of this technique are presented in Sections 2 and 3. Section 4 reviews the state-of-the-art sensors and research. Section 5 reviews the state of modern equipment, and Section 6 presents the applications and research trends of eddy current inspection. Finally, Section 7 presents a discussion of eddy current testing. Principles of Operation of Eddy Current Testing The objective of this section is to describe the principles of eddy current testing. A transformer model is presented to demonstrate the fundamentals of eddy current induction and the impedance changes that occur in coil sensors. After presenting operating principles, we present a block diagram of the constituent parts of eddy current testing equipment.

Chapter 3 : Non-Destructive Techniques Based on Eddy Current Testing

Partial support for this work was provided by the NSF-ATE (Advanced Technological Education) program through grant #DUE Opinions expressed are those of the authors and not necessarily those of the National Science Foundation.

The formation and suppression of eddy currents is here demonstrated by means of this pendulum, a metal plate oscillating between the pole pieces of a strong electromagnet. As soon as a sufficiently strong magnetic field has been switched on, the pendulum is stopped on entering the field. Eddy current brakes use the drag force created by eddy currents as a brake to slow or stop moving objects. Since there is no contact with a brake shoe or drum, there is no mechanical wear. However, an eddy current brake cannot provide a "holding" torque and so may be used in combination with mechanical brakes, for example, on overhead cranes. Another application is on some roller coasters, where heavy copper plates extending from the car are moved between pairs of very strong permanent magnets. Electrical resistance within the plates causes a dragging effect analogous to friction, which dissipates the kinetic energy of the car. The same technique is used in electromagnetic brakes in railroad cars and to quickly stop the blades in power tools such as circular saws. Using electromagnets, as opposed to permanent magnets, the strength of the magnetic field can be adjusted and so the magnitude of braking effect changed. Repulsive effects and levitation[edit] Main article: In a varying magnetic field the induced currents exhibit diamagnetic-like repulsion effects. A conductive object will experience a repulsion force. This can lift objects against gravity, though with continual power input to replace the energy dissipated by the eddy currents. An example application is separation of aluminum cans from other metals in an eddy current separator. Ferrous metals cling to the magnet, and aluminum and other non-ferrous conductors are forced away from the magnet; this can separate a waste stream into ferrous and non-ferrous scrap metal. With a very strong handheld magnet, such as those made from neodymium , one can easily observe a very similar effect by rapidly sweeping the magnet over a coin with only a small separation. Depending on the strength of the magnet, identity of the coin, and separation between the magnet and coin, one may induce the coin to be pushed slightly ahead of the magnet â€" even if the coin contains no magnetic elements, such as the US penny. Another example involves dropping a strong magnet down a tube of copper [7] â€" the magnet falls at a dramatically slow pace. In a perfect conductor with no resistance a superconductor , surface eddy currents exactly cancel the field inside the conductor, so no magnetic field penetrates the conductor. Since no energy is lost in resistance, eddy currents created when a magnet is brought near the conductor persist even after the magnet is stationary, and can exactly balance the force of gravity, allowing magnetic levitation. Superconductors also exhibit a separate inherently quantum mechanical phenomenon called the Meissner effect in which any magnetic field lines present in the material when it becomes superconducting are expelled, thus the magnetic field in a superconductor is always zero. Using electromagnets with electronic switching comparable to electronic speed control it is possible to generate electromagnetic fields moving in an arbitrary direction. As described in the section above about eddy current brakes, a non-ferromagnetic conductor surface tends to rest within this moving field. When however this field is moving, a vehicle can be levitated and propelled. This is comparable to a maglev but is not bound to a rail. The coin rolls past a stationary magnet, and eddy currents slow its speed. Slugs are slowed to a different degree than genuine coins, and this is used to send them into the rejection slot. Vibration and position sensing[edit] Eddy currents are used in certain types of proximity sensors to observe the vibration and position of rotating shafts within their bearings. This technology was originally pioneered in the s by researchers at General Electric using vacuum tube circuitry. In the late s, solid-state versions were developed by Donald E. Bently at Bently Nevada Corporation. These sensors are extremely sensitive to very small displacements making them well suited to observe the minute vibrations on the order of several thousandths of an inch in modern turbomachinery. Widespread use of such sensors in turbomachinery has led to development of industry standards that prescribe their use and application. A Ferraris acceleration sensor, also called a Ferraris sensor , is a contactless sensor that uses eddy currents to measure relative acceleration. Eddy currents are the root cause of the skin effect in conductors carrying AC current. Lamination of magnetic cores in transformers greatly improves the efficiency by minimising eddy currents Similarly, in magnetic materials of finite conductivity eddy currents cause the confinement of the majority of the magnetic fields to only a couple skin depths of the surface of the material. This effect limits the flux linkage in inductors and transformers having magnetic cores.

Chapter 4 : Eddy Current Testing - Entech Sales & Service, LLCEntech Sales & Service, LLC

Eddy Current Testing is an electromagnetic technique used on conductive materials to detect a number of conditions, including sub-surface defects, variations in material structure, thickness and corrosion.

Back to Resources By Tom Nelligan and Cynthia Calderwood Magnetism, the underlying principle behind electric motors and generators, relays and stereo speakers, is also the force that enables an important category of NDT tools called eddy current instruments. Eddy current testing is widely used in the aerospace industry and in other manufacturing and service environments that require inspection of thin metal for potential safety-related or quality-related problems. In addition to crack detection in metal sheets and tubing, eddy current can be used for certain metal thickness measurements such as identifying corrosion under aircraft skin, to measure conductivity and monitor the effects of heat treatment, and to determine the thickness of nonconductive coatings over conductive substrates. Both field portable and fixed system instruments are available to meet a wide variety of test needs. Eddy current NDT can examine large areas very quickly, and it does not require use of coupling liquids. In addition to finding cracks, eddy current can also be used to check metal hardness and conductivity in applications where those properties are of interest, and to measure thin layers of nonconductive coatings like paint on metal parts. At the same time, eddy current testing is limited to materials that conduct electricity and thus cannot be used on plastics. In some cases, eddy current and ultrasonic testing are used together as complementary techniques, with eddy current having an advantage for quick surface testing and ultrasonics having better depth penetration. How it works Eddy current testing is based on the physics phenomenon of electromagnetic induction. In an eddy current probe, an alternating current flows through a wire coil and generates an oscillating magnetic field. If the probe and its magnetic field are brought close to a conductive material like a metal test piece, a circular flow of electrons known as an eddy current will begin to move through the metal like swirling water in a stream. That eddy current flowing through the metal will in turn generate its own magnetic field, which will interact with the coil and its field through mutual inductance. Changes in metal thickness or defects like near-surface cracking will interrupt or alter the amplitude and pattern of the eddy current and the resulting magnetic field. This in turn affects the movement of electrons in the coil by varying the electrical impedance of the coil. The eddy current instrument plots changes in the impedance amplitude and phase angle, which can be used by a trained operator to identify changes in the test piece. Eddy current density is highest near the surface of the part, so that is the region of highest test resolution. Thus, variations in the conductivity of the test material, its magnetic permeability, the frequency of the AC pulses driving the coil, and coil geometry will all have an effect on test sensitivity, resolution, and penetration. There are many factors that will affect the capabilities of an eddy current inspection. Eddy currents traveling in materials with higher conductivity values will be more sensitive to surface defects but will have less penetration into the material, with penetration also being dependent on test frequency. Higher test frequencies increase near surface resolution but limit the depth of penetration, while lower test frequencies increase penetration. Larger coils inspect a greater volume of material from any given position, since the magnetic field flows deeper into the test piece, while smaller coils are more sensitive to small defects. Variations in permeability of a material generate noise that can limit flaw resolution because of greater background variations. In a given test, resolution will be determined by the probe type while detection capability will be controlled by material and equipment characteristics. Some inspections involve sweeping through multiple frequencies to optimize results, or inspection with multiple probes to obtain the best resolution and penetration required to detect all possible flaws. It is always important to select the right probe for each application in order to optimize test performance. Impedance plane displays While some older eddy current instruments used simple analog meter displays, the standard format now is an impedance plane plot that graphs coil resistance on the x-axis versus inductive reactance on the y-axis. Variations in the plot correspond to variations in the test piece. For example, the display below shows a setup for inspection for surface cracks in aluminum. The top curve represents a 0. The horizontal line is the lift off in which the probe has been "nulled" balanced on the aluminum part and when it is lifted in the air, the signal moves directly to the left. This inspection is done with a pencil probe. This display would be considered the calibration of the instrument. Once the parameters are set, they should not be changed during the inspection. The inspection measurements are dependent entirely on the comparison of the signal against the reference calibration. Another common test involves measurement of nonconductive coatings like paint over metals. The screen display below shows a nonmetallic coating over aluminum. For this application, the probe is "nulled" balanced in air and then placed on the sample. The top line shows the signal on aluminum without any coating. The second line down is a 0. To create this image, the display position had to be changed between each measurement in order to display a separation between each signal. After this calibration is done, the inspector would measure on their parts and watch for the distance that the signal travels across the screen. Alarms could be used to alert the inspector when a coating is too thick or too thin. A second way to measure the thickness of a nonconductive coating on a conductive material is using the conductivity measurement capability of the Olympus NDT N series instruments NC or higher. This measurement uses a special conductivity probe that displays the below screen instead of the standard impedance screen shown above. This measurement is most commonly used to determine the conductivity of a material but it will also provide the thickness of a coating which is considered the "Liftoff" from the material or how far the probe is above the surface of the conductive material. This example was a 0. Types of probes Eddy current instruments can perform a wide variety of tests depending on the type of probe being used, and careful probe selection will help optimize performance. Some common probe types are listed below. Surface probes - Used for identifying flaws on and below metal surfaces, usually large diameter to accommodate lower frequencies for deeper penetration, or for scanning larger areas. Pencil probes - Smaller diameter probes housing coils built for high frequencies for high resolution of near surface flaws. Bolt hole probes - Designed to inspect the inside of a bolt hole. These probes can be rotated by hand or automatically using a rotary scanner. Donut probes - Designed to inspect aircraft fastener holes with fasteners in place. Sliding probes - Also used in testing aircraft fastener holes, offering higher scan rates than donut probes. ID probes - Used for inspection of heat exchangers and similar metal tubing from the inside, available in a variety of sizes. OD probes - Used for inspection of metal tubing and bars from the outside, with the test piece passing through the coil Reference standards An eddy current system consisting of an instrument and a probe must always be calibrated with appropriate reference standards at the start of a test. This process involves identifying the baseline display from a given test piece and observing how it changes under the conditions that the test is intended to identify. In flaw detection applications, this calibration process typically involves the use of reference standards of the same material, shape, and size as the test piece, containing artificial defects such as saw cuts, drilled holes, or milled walls to simulate flaws. In thickness measurement applications the reference standards would consist of various samples of know thickness. The operator observes the response from the reference standards and then compares the indications from test pieces to these reference patterns to categorize parts. Proper calibration with appropriate reference standards is an essential part of any eddy current test procedure. Common applications Eddy current instruments can be used in a wide variety of tests. Some of the most common are listed below. Weld Inspection - Many weld inspections employ ultrasonic NDT for subsurface testing and a complimentary eddy current method to scan the surface for open surface cracks on weld caps and in heat affected zones. Surface Inspection - Surface cracks in machined parts and metal stock can be readily identified with eddy current. This includes inspection of the area around fasteners in aircraft and other critical applications. Corrosion Detection - Eddy current instruments can be used to detect and quantify corrosion on the inside of thin metal such as aluminum aircraft skin. Low frequency probes can be used to locate corrosion on second and third layers of metal that cannot be inspected ultrasonically. Bolt Hole Inspection - Cracking inside bolt holes can be detected using bolt hole probes, often with automated rotary scanners. Tubing inspection - Both in-line inspection of tubing at the manufacturing stage and field inspection of tubing like heat exchangers are common eddy current applications. Both cracking and thickness variations can be detected. Eddy current arrays Eddy Current Array testing, or ECA, is a technology that provides the ability to simultaneously use multiple eddy current coils that are placed side by side in the same probe assembly. Each individual coil produces a signal relative to the phase and amplitude of the structure below it. This data is referenced to an encoded position and time and represented graphically as a C-scan image showing structures in a planar view. In addition to providing visualization through C-scan imaging, ECA allows coverage of larger areas in a single pass while maintaining high resolution. ECA can permit use of simpler fixturing, and can also simplify inspection of complex shapes through custom probes built to fit the profile of the test piece.

Chapter 5 : Eddy current - Wikipedia

Eddy current testing - Physical background - Eddy current testing with coaxial probes - Eddy current testing with surface probes - Practice Responsible for this video: Prof. Dr.-Ing. Rainer Schwab.

ECT is also useful in making electrical conductivity and coating thickness measurements, among others. Other eddy current testing techniques[edit] To circumvent some of the shortcomings of conventional ECT, other eddy current testing techniques were developed with various successes. Pulsed eddy current[edit] Conventional ECT uses sinusoidal alternating current of a particular frequency to excite the probe. Pulsed eddy current PEC testing uses a step function voltage to excite the probe. The advantage of using a step function voltage is that such a voltage contains a range of frequencies. As a result, the electromagnetic response to several different frequencies can be measured with just a single step. Since depth of penetration depends on the excitation frequency, information from a range of depths can be obtained all at once. If measurements are made in the time domain that is, by looking at the strength of the signal as a function of time , indications produced by defects and other features near the inspection coil can be seen first and more distant features will be seen later in time. With pulse methods, the frequencies are excited over a wide band, the extent of which varies inversely with the pulse length; this allows multi-frequency operation. The total amount of energy dissipated within a given period of time is considerably less for pulsed waves than for continuous waves of the same intensity, thus allowing higher input voltages to be applied to the exciting coil for PEC than conventional ECT. Testing can be performed through coatings, sheathings, corrosion products and insulation materials. ECA technology provides the ability to electronically drive an array of coils multiple coils arranged in specific pattern called a topology that generates a sensitivity profile suited to the target defects. Data acquisition is achieved by multiplexing the coils in a special pattern to avoid mutual inductance between the individual coils. The benefits of ECA are: Lorentz force eddy current testing[edit] A different, albeit physically closely related challenge is the detection of deeply lying flaws and inhomogeneities in electrically conducting solid materials. Adapted from [14] In the traditional version of eddy current testing an alternating AC magnetic field is used to induce eddy currents inside the material to be investigated. If the material contains a crack or flaw which make the spatial distribution of the electrical conductivity nonuniform, the path of the eddy currents is perturbed and the impedance of the coil which generates the AC magnetic field is modified. By measuring the impedance of this coil, a crack can hence be detected. Since the eddy currents are generated by an AC magnetic field, their penetration into the subsurface region of the material is limited by the skin effect. The applicability of the traditional version of eddy current testing is therefore limited to the analysis of the immediate vicinity of the surface of a material, usually of the order of one millimeter. Attempts to overcome this fundamental limitation using low frequency coils and superconducting magnetic field sensors have not led to widespread applications. A recent technique, referred to as Lorentz force eddy current testing LET , [14] [15] exploits the advantages of applying DC magnetic fields and relative motion providing deep and relatively fast testing of electrically conducting materials. In principle, LET represents a modification of the traditional eddy current testing from which it differs in two aspects, namely i how eddy currents are induced and ii how their perturbation is detected. In LET eddy currents are generated by providing the relative motion between the conductor under test and a permanent magnet see figure. If the magnet is passing by a defect, the Lorentz force acting on it shows a distortion whose detection is the key for the LET working principle. If the object is free of defects, the resulting Lorentz force remains constant.

Chapter 6 : Eddy current testing | Institut Dr. Foerster GmbH und Co. KG

Eddy Current Testing Since , ATS has been a leading NDT company offering a wide variety of services to many industries. Applied Technical Services offers Eddy Current Non Destructive Testing for crack detection, material or coating thickness and conductivity measurements.

As technological leader, we have made it our mission to visualize quality and to help shape the future of non-destructive testing. Automotive The automotive sector and its continuously increasing quality requirements present suppliers with ever increasing challenges. Consistent quality control of individual components is therefore the standard in modern production lines so as to meet these requirements. Aerospace The aerospace sector is characterized by innovation and hightech. Apart from the development of aircraft, spacecraft, and satellites, servicing also forms an important segment within the sector. Medical technology Medical technology is engaged in the application and implementation of technical products and services in the medical sector. The aim is to continuously improve aspects such as diagnostics, therapy, and the quality of life of patients. It is therefore of great importance to produce defect-free materials. Plant and mechanical engineering FOERSTER produces individual test instruments as well as complex multi-function test blocks with various integrated test systems. FOERSTER aims to offer excellent advice and close cooperation to its customers to ensure that these systems are tailored to meet their specific requirements. Explosive ordnance detection Today, the soil on this planet still contains weapons from previous wars, which pose a potential risk. We therefore help to increase safety. Military technology Military technology is characterized by great innovation comprised of various engineering sciences. Many military technology developments have also found their firm place in civil life. Petrochemical industry The petrochemical sector produces chemical products from natural gas and crude oil. This process takes place in refineries and steam reforming plants. Oil and gas industry Natural gas and crude oil are important raw substances used by many industries. They form the basis for all types of plastic and serve as fossil energy carriers for the production of electricity and as fuel for almost all types of vehicles. Defect-free materials are a basic requirement to ensure a smooth production process. Archeology What was life like in the past? Archeology attempts to find answers to these questions and FOERSTER supports such projects by providing probes for the non-destructive visualization of traces from times gone by hidden in the ground.

Chapter 7 : Introduction to Eddy Current Testing | Olympus IMS

Eddy current testing is an inspection method that can be used for a variety of purposes including the detection of cracks and corrosion, material and coating thickness measurement, material identification and, in certain materials, heat treatment condition.

Eddy current array ECA is a nondestructive testing technology that provides the ability to electronically drive multiple eddy current coils, which are placed side by side in the same probe assembly. Each individual eddy current coil in the probe produces a signal relative to the phase and amplitude of the structure below it. This data is referenced to an encoded position and time and represented graphically as a C-scan image. Most conventional eddy current flaw detection techniques can be reproduced with ECA inspections; however, the remarkable advantages of ECA technology allow improved inspection capabilities and significant time savings. ECA technology includes the following advantages: A larger area can be scanned in a single-probe pass, while maintaining a high resolution. Less need for complex robotics to move the probe; a simple manual scan is often enough. C-scan imaging improves flaw detection and sizing. Complex shapes can be inspected using probes customized to the profile of the part being inspected. Eddy current EC testing is a no contact method for the inspection of metallic parts. Eddy currents are fields of alternating magnetic current that are created when an alternating electric current is passed through one or more coils in a probe assembly. When the probe is linked with the part under inspection, the alternating magnetic field induces eddy currents in the test part. Discontinuities or property variations in the test part change the flow of the eddy current and are detected by the probe in order to make material thickness measurements or to detect defects such as cracks and corrosion. Over the years, probe technology and data processing have advanced to the point where eddy current testing is recognized as being fast, simple, and accurate. Foucault built a device that used a copper disk moving in a strong magnetic field to show that eddy currents magnetic fields are generated when a material moves within an applied magnetic field. Faraday discovered that when a magnetic field passes through a conductor a material in which electrons move easily -or when a conductor passes through a magnetic field-an electric current will flow through the conductor if there is a closed path through which the current can circulate. In , another breakthrough was made when another English scientist, David Hughes, demonstrated how the properties of a coil change when placed in contact with metals of different conductivity and permeability. However, it was not until the Second World War that these developments in the transmitting and receiving of electromagnetic waves were put to practical use for materials testing. Other companies soon followed. Many advances were made throughout the s and s, especially in the aircraft and nuclear industries. There have been many recent developments in eddy current testing, leading to improved performance and the development of new applications. Eddy current testing is now a widely used and well-understood inspection technique for flaw detection as well as for thickness and conductivity measurements. The expert knowledge and practical experience of more than 35 years eddy-current services enables them to their unique position in the international NDT-market. How does Eddy Current works The drawings below represents schematically how does eddy current works. The coil red causes a magnetic field, which initiate eddy current. If a defect appears in the effective area, the eddy current have to take a different way, this changes the impedance of the coil and the operator see the changes on his screen Z1-Z2. Eddy current stands for: Pipe inspection of Heat Exchangers Various materials could be checked, like carbon steel, stainless steel, duplex, alloy or other conductive materials. The drawing below represents schematically the defect detection by eddy current. The two coils red were pulled over the defect and the typical signal appeared on the screen. The inner and outer defects have different signals depending on their deepness. This gives the operator the opportunity to decide what kind of defect is in the tube. Eddy current testing is always a comparative measurement, therefore EC-Works need: Special probes allow to detect inside cracks from outside, depending on the material and wall thickness. Andreas, Sven, Frank and his son Thanks for the pleasant cooperation. Benefits of Eddy Current Testing Eddy current offers the following capabilities: Quick, simple, and reliable inspection technique to detect surface and near-surface defects in conductive material Can be used to measure material electrical conductivity Measurement of nonconductive coating Hole inspection with the use of high-speed rotating scanner and surface probe Benefits of Eddy Current Array Testing Compared to single-channel eddy current technology, eddy current array technology provides the following benefits: Drastically reduces inspection time. Covers a large area in one single pass. Reduces the complexity of mechanical and robotic scanning systems. Provides real-time cartography of the inspected region, facilitating data interpretation. Is well suited for complex part geometries. Improves reliability and probability of detection POD.

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Chapter 8 : Eddy Current: Business & Industrial | eBay

Eddy current testing is a non-destructive method for testing metal surfaces for defects such as longitudinal and transverse cracks. The type of testing performed, using comprehensive through-type coils or rotating probes, depends on the type of defect.

NABL ISO Accredited - Eddy Current Testing Inspection Labs at Trinity NDT Eddy current testing is a modern Nondestructive testing â€" NDT method and prime tool in controlling quality of components for Aerospace, automotive, heat exchanger tubes, pipes for oil, gas and structural applications at various stages of manufacturing and in-service inspections for surface and subsurface crack testing. This NDT Inspection method can be used to find finest surface and subsurface flaws in any conductive material. Present Eddy current NDT method has applications in Aerospace Component Inspections, Heat exchanger tube inspections in Oil Gas companies, real time non-contact thickness measurement to control process quality, Material sorting, mixing, Paint and nonconductive coating thickness measurements. Demand for testing is steeply rising due to increasing usage of nonferrous conducting materials for vast number of engineering applications. Trinity NDT labs are NABL Accredited ISO certified Eddy current testing and the principles can be used for the following engineering applications Material sorting â€" Automobile and precision engineering components manufacturers are processing varieties of components. There could be variation design, chemistry, heat treatment or other properties in materials. The most common problem in shop floors is mix up of various grade of materials either chemically different or variation in mechanical properties or metallurgically difference in structures. Various methods of sorting the materials are used but Eddy current testing is the cost effective and less time consuming means of arriving at right conclusion. It is increasing becoming common to sort out the materials, metals components using Eddy current Inspection Technique. Flaws could be cracks, delaminations, and other discontinuities that can be detrimental to the product performance Conductivity testing for metals to find conductivity and correlate to purity of metals such measuring purity of copper and other conducting materials during manufacturing or in-service inspections. It is possible to measure coating thickness using Non-contact method by Eddy current testing techniques. The coating can be conductive or non-conductive with few limitations on the accuracy of measurements. Eddy current inspection can be effectively used to find thickness of coatings including paint thickness measurements. This modern NDT inspection method can also be used for measuring low thicknesses of the order of few millimeters for conductive materials where there is a restriction on using Ultrasonic thickness gauging due to component configuration or the quantum of inspection. Eddy current inspections can be either contact or non-contact type tests. Non- contact methods are suitable for automation and can be used to control process quality for measuring thickness online during manufacturing such as monitoring thickness of Pipes,Tubes, Plates etc. Eddy current inspection is an effective means of verifying of integrity of engineering structures and estimation of corrosion damages on heat exchanger tubes in Petroleum refineries in Oil and Gas Sector. Routine in-service maintenance inspections using Eddy current techniques yield reliable data for analysis and condition monitoring of Petroleum refineries, power plants, cement plants and structures. Eddy current inspection detects discontinuities on conducting materials. Magnetic particle testing is impossible to carried out on non-magnetic materials such as Aluminium, Titanium, Magnesium, Copper etc. Eddy current tests are also used to find fine fatigue cracks on aircraft skins, fastener holes and turbine components. High speed rotating scanners fitted to eddy current equipment machines can perform crack detection with greater speed in a minimum of time. In fact it is the first NDT inspection company in India to get accreditation in Ultrasonic testing, Radiography, Eddy current testing, Liquid dye penetrant testing, Magnetic particle inspections. Multi frequency capability to inspection cracks and corrosion damages in heat exchanger tube inspections. Our eddy current testing equipments are equipped with Rotating scanner option for inspecting Aircraft bolt holes and Aircraft skins. Impedance plane display equipments that are designed for general and critical Eddy current inspections. Built in defect recording makes testing and printing reports and finishing the tasks quickly to fulfill inspection requirements. We can perform inspection both in-house and onsite at your site or works. So eddy currents are circular alternating currents caused by a varying magnetic field. Eddy current behavior depends on the properties of both the flux and the specimen itself. If there is a disturbance in eddy current flow paths that will provide an indication for interpretation and evaluation. Contact us for more information on courses eligibility , fee structure and training schedules.

Chapter 9 : Eddy Current Testing | ATS

Eddy Current Testing and Industry Eddy current inspection can be used across a wide range of industries for a large number of applications. Figure 6 demonstrates the industries that this technique can be used in, the application types and what type of probe you would use to complete your eddy current inspection.