Pulsed Eddy Current Non-destructive Testing and Evaluation: A Review (Review)
Sophian, A.¹, Tian, G.²,³, Fan, M.⁴
¹Faculty of Engineering, International Islamic University Malaysia, Kuala Lumpur, Malaysia
²School of Automation Engineering, University of Electronic Science and Technology of China, Chengdu, China
³School of Electrical and Electronic Engineering, Newcastle University, Newcastle upon Tyne, United Kingdom

Abstract
Pulsed eddy current (PEC) non-destructive testing and evaluation (NDT&E) has been around for some time and it is still attracting extensive attention from researchers around the globe, which can be witnessed through the reports reviewed in this paper. Thanks to its richness of spectral components, various applications of this technique have been proposed and reported in the literature covering both structural integrity inspection and material characterization in various industrial sectors. To support its development and for better understanding of the phenomena around the transient induced eddy currents, attempts for its modelling both analytically and numerically have been made by researchers around the world. This review is an attempt to capture the state-of-the-art development and applications of PEC, especially in the last 15 years and it is not intended to be exhaustive. Future challenges and opportunities for PEC NDT&E are also presented. © Chinese Mechanical Engineering Society and Springer-Verlag Berlin Heidelberg 2017

Author keywords
Material characterization Non-destructive evaluation Non-destructive testing Pulsed eddy currents Structural integrity

Indexed keywords
Engineering controlled terms: Bridge decks Characterization Nondestructive examination Structural integrity
Compendex keywords Development and applications Induced eddy currents Material characterizations Non destructive evaluation Non destructive testing Non-destructive testing and evaluations Pulsed eddy current Spectral components

Engineering main heading: Eddy current testing

Cited by 2 documents
Pulsed eddy current imaging of inclined surface cracks
Effects of Coil Diameter in Thickness Measurement Using Pulsed Eddy Current Non-destructive Testing

Funding details
Funding number Funding sponsor Acronym Funding opportunities
China University of Mining and Technology CUMT See opportunities by CUMT
Newcastle University
National Natural Science Foundation of China NSFC See opportunities by NSFC
Ministry of Higher Education, Malaysia MOHE See opportunities by MOHE

Funding text
The authors would like to thank Ministry of Higher Education of Malaysia for funding the project on PEC NDT at IIUM through the research grant FRGS16-059-0558. This work is also supported by the National Natural Science Foundation of China under research grants 51677187 and 51307172. Dr. Mengbao Fan would like to thank China Jiangsu Provincial Department of Education and China University of Mining and Technology for sponsoring his visit to Newcastle University as an academic visitor.

References (97)


7 Li, J., Wu, X., Zhang, Q., Sun, P.
Measurement of lift-off using the relative variation of magnetic flux in pulsed eddy current testing
doi: 10.1016/j.ndteint.2015.06.008
View at Publisher

8 Huang, C., Wu, X.
An improved ferromagnetic material pulsed eddy current testing signal processing method based on numerical cumulative integration
doi: 10.1016/j.ndteint.2014.09.006
View at Publisher

9 Blitz, J.
Eddy current testing of metals

10 Desjardins, D., Krause, T.W., Clapham, L.
Transient eddy current method for the characterization of magnetic permeability and conductivity
doi: 10.1016/j.ndteint.2016.02.010
View at Publisher

11 Desjardins, D., Krause, T.W., Clapham, L.
Transient response of a driver-pickup coil probe in transient eddy current testing
doi: 10.1016/j.ndteint.2015.04.008
View at Publisher

12 Vasić, D., Bilas, V., Ambruš, D.
Pulsed eddy-current nondestructive testing of ferromagnetic tubes
doi: 10.1109/TIM.2004.830594
View at Publisher

13 Park, D.G., Angani, C.S., Cheong, Y.M.
Differential pulsed eddy current probe to detect the sub surface cracks in a stainless steel pipe

14 Horan, P., Underhill, P.R., Krause, T.W.
Pulsed eddy current detection of cracks in F/A-18 inner wing spar without wing skin removal using Modified Principal Component Analysis
doi: 10.1016/j.ndteint.2013.01.004
View at Publisher
15 He, Y., Luo, F., Pan, M., Weng, F., Hu, X., Gao, J., Liu, B.
   Pulsed eddy current technique for defect detection in aircraft riveted structures
   doi: 10.1016/j.ndteint.2009.10.010
   View at Publisher

16 Abrantes, R.F., Rosado, L.S., Piedade, M., Ramos, P.M.
   Pulsed eddy currents testing using a planar matrix probe
   doi: 10.1016/j.measurement.2015.09.026
   View at Publisher

   Southwest Research Institute

18 Yang, G., Tamburrino, A., Udpa, L., Udpa, S.S., Zeng, Z., Deng, Y., Que, P.
   Pulsed eddy-current based giant magneto resistive system for the inspection of aircraft structures
   doi: 10.1109/TMAG.2009.2032330
   View at Publisher

19 He, Y., Pan, M., Luo, F., Tian, G.
   Pulsed eddy current imaging and frequency spectrum analysis for hidden defect nondestructive testing and evaluation
   doi: 10.1016/j.ndteint.2011.01.009
   View at Publisher

20 He, Y., Luo, F., Pan, M., Hu, X., Gao, J., Liu, B.
   Defect classification based on rectangular pulsed eddy current sensor in different directions
   doi: 10.1016/j.sna.2009.11.012
   View at Publisher

21 Arjun, V., Sasi, B., Rao, B.P.C., Mukhopadhay, C.K., Jayakumar, T.
   Optimisation of pulsed eddy current probe for detection of sub-surface defects in stainless steel plates
   doi: 10.1016/j.sna.2015.02.018
   View at Publisher

22 Zhou, D., Wang, J., He, Y., Chen, D., Li, K.
   Influence of metallic shields on pulsed eddy current sensor for ferromagnetic materials defect detection
   doi: 10.1016/j.sna.2016.07.029
   View at Publisher


Panaitov, G., Krause, H.-J., Zhang, Y.  
Pulsed eddy current transient technique with HTS SQUID magnetometer for non-destructive evaluation  
doi: 10.1016/S0921-4534(02)00696-2  
View at Publisher

Li, Y., Yan, B., Li, D., Li, Y., Zhou, D.  
Gradient-field pulsed eddy current probes for imaging of hidden corrosion in conductive structures  
doi: 10.1016/j.sna.2015.12.026  
View at Publisher

Joubert, P.-Y., Le Diraison, Y., Xi, Z., Vourc’H, E.  
Pulsed eddy current imaging device for non destructive evaluation applications  
doi: 10.1109/ICSENS.2013.6688145  
View at Publisher

Joubert, P.-Y., Le Diraison, Y.  
Pulsed eddy current imager for the enhanced non destructive evaluation of aeronautical riveted assemblies  
http://www.ieee.org/sensors  
doi: 10.1109/ICSENS.2014.6985221  
View at Publisher

Majidnia, S., Nilavalan, R., Rudlin, J.  
Investigation of an encircling pulsed eddy current probe for corrosion detection  
http://www.ieee.org/sensors  
doi: 10.1109/ICSENS.2014.6985129  
View at Publisher

Dai, X.-W., Ludwig, R., Palanisamy, R.  
Numerical Simulation of Pulsed Eddy-Current Nondestructive Testing Phenomena  
doi: 10.1109/20.102897  
View at Publisher

Ludwig, R., Dai, X.-W.  
Numerical and Analytical Modeling of Pulsed Eddy Currents in a Conducting Half-Space  
doi: 10.1109/20.50558  
View at Publisher
Finite element modeling of pulsed eddy current NDT phenomena

doi: 10.1109/TMAG.1985.1064184

Analytical modeling of the transient response of a coil encircling a ferromagnetic conducting rod in pulsed eddy current testing

doi: 10.1016/j.ndteint.2013.07.007

Analytical modeling for transient probe response in pulsed eddy current testing

doi: 10.1016/j.ndteint.2009.01.005

Time-domain analytical solutions to pulsed eddy current field excited by a probe coil outside a conducting ferromagnetic pipe

doi: 10.1016/j.ndteint.2014.07.005

Computation of coil-induced voltage due to a defect-free plate using Stehfest's method for pulsed eddy current evaluation

doi: 10.1784/insi.2010.52.6.302

Electrical conductivity measurement of ferromagnetic metallic materials using pulsed eddy current method

doi: 10.1016/j.ndteint.2015.06.005

Extension of a model for eddy current inspection of cracks to pulsed excitations

doi: 10.1016/j.ndteint.2012.01.005
46  Liu, S.-X., Xin, W., Ding, K.-Q.
Simulation of corrosion on detection for pulsed eddy current
ISBN: 978-142445934-6
doi: 10.1109/FSKD.2010.5569432
View at Publisher

47  Pávó, J.
Numerical calculation method for pulsed eddy-current testing
doi: 10.1109/20.996299
View at Publisher

48  Alamin, M., Tian, G.Y., Andrews, A., Jackson, P.
Principal component analysis of pulsed eddy current response from corrosion in mild steel
doi: 10.1109/JSEN.2012.2195308
View at Publisher

49  Xu, Z., Wu, X., Li, J., Kang, Y.
Assessment of wall thinning in insulated ferromagnetic pipes using the time-to-peak of differential pulsed eddy-current testing signals
doi: 10.1016/j.ndteint.2012.07.004
View at Publisher

50  Tian, G.Y., Sophian, A.
Defect classification using a new feature for pulsed eddy current sensors
doi: 10.1016/j.ndteint.2004.06.001
View at Publisher

51  Chen, X., Hou, D., Zhao, L., Huang, P., Zhang, G.
Study on defect classification in multi-layer structures based on Fisher linear discriminate analysis by using pulsed eddy current technique
doi: 10.1016/j.ndteint.2014.07.003
View at Publisher

52  BinFeng, Y., FeiLu, L., Dan, H.
Research on edge identification of a defect using pulsed eddy current based on principal component analysis
doi: 10.1016/j.ndteint.2006.12.005
View at Publisher
Independent component analysis-based feature extraction technique for defect classification applied for pulsed eddy current NDE

doi: 10.1080/09349840903078996

View at Publisher

A feature extraction technique based on principal component analysis for pulsed Eddy current NDT

doi: 10.1016/S0963-8695(02)00069-5

View at Publisher

Real time pulsed eddy current detection of cracks in F/A-18 inner wing spar using discriminant separation of modified principal components analysis scores

doi: 10.1109/JSEN.2013.2281368

View at Publisher

Defect classification by pulsed eddy current technique in con-casting slabs based on spectrum analysis and wavelet decomposition

doi: 10.1016/j.sna.2013.09.004

View at Publisher

Defect characterisation using pulsed eddy current thermography under transmission mode and NDT applications

doi: 10.1016/j.ndteint.2012.08.007

View at Publisher

Pulsed eddy current detection of cracks in multilayer aluminum lap joints

doi: 10.1109/JSEN.2014.2354404

View at Publisher

Pulsed eddy current inspection of support structures in steam generators

doi: 10.1109/JSEN.2015.2418220

View at Publisher


<table>
<thead>
<tr>
<th>ID</th>
<th>Reference Details</th>
</tr>
</thead>
</table>
doi: 10.1088/0957-0233/19/8/085701  |
doi: 10.1063/1.1916720  |

View at Publisher


View at Publisher


View at Publisher


View at Publisher


View at Publisher

© Copyright 2017 Elsevier B.V., All rights reserved.

About Scopus

What is Scopus
Content coverage
Scopus blog
Scopus API
Privacy matters

Language

日本語に切り替え
切換到简体中文
切換到繁體中文
Русский язык

Customer Service

Help
Contact us