Tho T Nguyen

PhD CEng MIMechE, Research Associate at Loughborough University

ngtruongtho@yahoo.fr

Summary

Mechanical Engineer with PhD degree in mechanical engineering | Expertise in finite element analysis, computer-aided design, computational mechanics, and topology optimisation applied in additive manufacturing | Working experience in structural analysis of oil&gas equipment and aerospace structures | Project management skills | Communication skills gained from many teaching, networking and charity works | Seeking an engineering career in academia and industry.

Experience

Research Associate at Loughborough University

April 2015 - Present (1 year 3 months)

http://www.lboro.ac.uk/research/amrg/

Solid-state AM | Material Direct Writing | Metrology in AM | Sensors integration | Research | Teaching | Collaborations | Project managememt

Research Fellow at The University of Nottingham

April 2014 - April 2015 (1 year 1 month)

http://www.3dp-research.com/

Mechanical design | Topology optimisation | Research | Collaborations | Project management

Resident Tutor at The University of Nottingham

May 2014 - January 2015 (9 months)

Member of management team, provide pastoral care of students living in the hall.

Teaching Assistant at Loughborough University

2009 - 2013 (4 years)

Teaching | Computer labs | Industrial projects | Undergraduates & Postgraduates | CAD | Siemens NX | SolidWorks | MatLab | Simulink

Part-time contractor at National Oilwell Varco, Downhole - eTools, UK

October 2011 - April 2012 (7 months)

Team working | Numerical simulations of drilling tools | Report writing

Volunteer at Loughborough Students Union

October 2010 - June 2011 (9 months)

A-teams project | Running project

Skills & Expertise

Research
Finite Element Analysis
Optimization
Simulations
Computational Solid Mechanics
Fourier transforms and Applications
Numerical Analysis
Materials Science
CFD
Solid Mechanics
Fluid Mechanics
Thermodynamics
Fluid Dynamics
Fortran
Heat Transfer
Matlab
Simulink
Abaqus
Hyperworks
ANSYS
Optistruct
Msc.Marc
Nastran
MSC.Patran
Msc.Nastran
Engineering

Education

Loughborough University
PhD, Mechanical Engineering, 2009 - 2013

Bandung Institute of Technology
MEng, Aeronautics and Astronautics, 2006 - 2008
Grade: Cum Laude Honour (~Distinction)

Hanoi University of Technology
BEng, Aeronautical Engineering, 2001 - 2006
Grade: Ranked 1st out of 24 students

Languages

Vietnamese	(Native or bilingual proficiency)
English	(Full professional proficiency)
French	(Professional working proficiency)

Indonesian (Elementary proficiency)

Courses

PhD, Mechanical Engineering

Loughborough University

Advanced Nonlinear Finite Element Modelling | One-week training course organised by Msc Software

Composite Finite Element Analysis | Four-week training course organised by the National Agency for Finite Element Method and Standards (NAFEMS)

Structural Optimisation in Finite Element Analysis | Four-week training course organised by the National Agency for Finite Element Method and Standards (NAFEMS)

Research Fellow

The University of Nottingham

Generating Robust Designs with HyperStudy | Full-day training course organised by Altair HyperWorks

Independent Coursework

Personal Development Courses | 20+ short courses organised by Loughborough/ Nottingham University, including time and self-management, ethical thinking, career management, working effectively with outside organisations, practical project management, etc.

Publications

Fourier-series-based virtual fields method for the identification of 2-D stiffness distributions

International Journal for Numerical Methods in Engineering April 2014

Authors: Tho T Nguyen, Jonathan Huntley, Ian Ashcroft, Pablo Ruiz, Fabrice Pierron

The virtual fields method (VFM) is a powerful technique for the calculation of spatial distributions of material properties from experimentally determined displacement fields. A Fourier-series-based extension to the VFM (the F-VFM) is presented here, in which the unknown stiffness distribution is parameterised in the spatial frequency domain rather than in the spatial domain as used in the classical VFM. We present in this paper the theory of the F-VFM for the case of elastic isotropic thin structures with known boundary conditions. An efficient numerical algorithm based on the two-dimensional Fast Fourier Transform (FFT) is presented, which reduces the computation time by three to four orders of magnitude compared with a direct implementation of the F-VFM for typical experimental dataset sizes. Artefacts specific to the F-VFM (ringing at the highest spatial frequency near to modulus discontinuities) can be largely removed through the use of appropriate filtering strategies. Reconstruction of stiffness distributions with the F-VFM has been validated on three stiffness distribution scenarios under varying levels of noise in the input displacement fields. Robust reconstructions are achieved even when the displacement noise is higher than in typical experimental fields.

A Fourier-series-based Virtual Fields Method for the Identification of 2-D Stiffness and Traction Distributions

Strain   September 2014

Authors: Tho T Nguyen, Jonathan Huntley, Ian Ashcroft, Pablo Ruiz, Fabrice Pierron

The virtual fields method (VFM) allows spatial distributions of material properties to be calculated from experimentally determined strain fields. A numerically efficient Fourier-series-based extension to the VFM (the F-VFM) has recently been developed, in which the unknown stiffness distribution is parameterised in the spatial frequency domain rather than in the spatial domain as used in the classical VFM. However, the boundary conditions for the F-VFM are assumed to be well-defined, whereas in practice, the traction distributions on the perimeter of the region of interest are rarely known to any degree of accuracy. In the current paper, we therefore consider how the F-VFM theory can be extended to deal with the case of unknown boundary conditions. Three different approaches are proposed; their ability to reconstruct normalised stiffness distributions and traction distributions around the perimeter from noisy input strain fields is assessed through simulations based on a forward finite element analysis. Finally, a practical example is given involving experimental strain fields from a diametral compression test on an aluminium disc.

Fast Fourier Virtual Fields Method for Determination of Modulus Distributions from Full-Field Optical Strain Data

Springer Berlin Heidelberg   September 2013

Authors: Tho T Nguyen, Jonathan Huntley, Ian Ashcroft, Pablo Ruiz, Fabrice Pierron

Inspection of parts for manufacturing defects or in-service damage is often carried out by full-field optical techniques (e.g., digital speckle pattern interferometry, digital holography) where the high sensitivity allows small anomalies in a load-induced deformation field to be measured. Standard phase shifting and phase unwrapping algorithms provide full-field displacement and hence strain data over the surface of the sample. The problem remains however of how to quantify the spatial variations in modulus due, for example, to porosity or damage-induced micro-cracking. Finite element model updating (FEMU) is one method to solve problems of this type, by adjusting an approximate finite element model until the responses it produces are as close to those acquired from experiments as possible.

An alternative approach is the Virtual Fields Method (VFM). The advantage of the VFM over other methods is its ability to solve inverse problems of this type without iterative computation. Several approaches based on polynomial virtual fields with the material properties considered as to be single valued within the domain have been developed. The first attempt to parameterize the material
properties as a function of spatial variables was proposed.

In this paper, we retain the basic concepts of the VFM but approach the parameterization of the material properties in the spatial frequency, rather than spatial, domain by performing a 2-D Fourier series expansion of the stiffness distribution over the region of interest. Furthermore, the virtual fields are not selected as polynomials of spatial variables as in the previous VFM literature, but from a set of simple cosine or sine functions of different spatial frequencies. This Fourier version of the VFM will be denoted the F-VFM. An example of its successful application to the identification of an unknown stiffness distribution under known boundary conditions is summarized here.

Fourier-series-based Virtual Fields Method for the identification of 3-D stiffness distributions

16th International Conference on Experimental Mechanics (ICEM16), 7-11 July 2014, At Cambridge, UK   July 2014

Authors: Tho T Nguyen, Jonathan Huntley, Ian Ashcroft, Pablo Ruiz, Fabrice Pierron

The virtual fields method (VFM) is a powerful technique for determining stiffness distributions of a sample, based on measured full-field strain data. The advantage of the VFM over many other methods is its ability to solve inverse problems of this type without any iteration. A key step in any application of the VFM is the selection of the virtual fields. Several techniques are based on the use of polynomials of spatial variables (either on the whole domain or in a piecewise form), and the material properties are considered as having single values (homogeneous) within the domain. The first attempt to parameterise the material properties as a function of spatial variables was proposed for reconstruction of the stiffness map of a plate with impact damage.

In this paper, we retain the basic concepts underlying the VFM but approach the parameterisation of the material properties in the spatial frequency, rather than spatial, domain by performing a 3-D Fourier series expansion of the stiffness distribution over the region of interest. Furthermore, the virtual fields are not selected as polynomials of spatial variables as in the previous VFM literature, but from a set of simple cosine or sine functions of different spatial frequencies. The abbreviation F-VFM will be used to denote the VFM in which both a Fourier series is used for the material property parameterization, and cosine/sine functions for the virtual fields. The F-VFM was developed originally for 2-D geometries; here it is extended to volumetric datasets resulting, for example, from measurements with Digital Volume Correlation or Phase Contrast Magnetic Resonance Imaging.

The Fourier Virtual Fields Method for the identification of material property distributions

PhD Thesis, Loughborough University   June 2013

Authors: Tho T Nguyen

The requirement of a fast and accurate modulus identification technique has arisen in many fields of research, such as solid mechanics, structural health monitoring, medical diagnosis, etc. An inverse technique based on an appropriate interpretation of the principle of virtual work, namely the virtual fields method, has been proposed in the literature, which is able to return elastic modulus values after a single matrix inversion.
An extension of the virtual fields method to the spatial frequency domain in order to determine modulus distributions of materials based on a sine/cosine parameterisation of the unknown modulus is developed in this thesis, and will be called the Fourier-series-based Virtual Fields Method (F-VFM). The technique

accepts in-plane (two-dimensional) or volumetric (three-dimensional) deformation measurement data as its input. An efficient numerical algorithm of the F-VFM based on the fast Fourier transform is presented, which can return thousands of unknown Fourier coefficients within a minute thus reducing the computation time by several orders of magnitude compared to a direct implementation of the F-VFM for typical dataset sizes.The F-VFM technique is also adapted to cope with a common situation in experimental mechanics where the knowledge of the boundary conditions is limited. The three versions of the F-VFM in this situation are respectively the ‘experimental traction’, ‘windowed traction’ and ‘Fourier-series traction’ approaches. The technique is then validated with numerical data from different stiffness patterns. The performance is compared to that of an iterative updating technique based on a genetic algorithm for one of these patterns, and computational effort is demonstrated to be at least five orders of magnitude less for the new F-VFM than for this updating method. The sensitivity of the performance of the FVFM to noise is also investigated. ***

Fourier-series-based Virtual Fields Method for the identification of 2-D stiffness distributions

Photomechanics 2013, 27-29 May 2013, At Montpellier, France   May 2013

Authors: Tho T Nguyen, Jonathan Huntley, Ian Ashcroft, Pablo Ruiz, Fabrice Pierron

The Virtual Fields Method (VFM) is a powerful technique for the calculation of spatial distributions of material properties from experimentally-determined displacement fields. A Fourier-series-based extension to the VFM (the F-VFM) is presented here, in which the unknown stiffness distribution is parameterised in the spatial frequency domain rather than in the spatial domain as used in the classical VFM. We summarise here the theory of the F-VFM for the case of elastic isotropic thin structures with known boundary conditions. An efficient numerical algorithm based on the 2-D Fast Fourier Transform reduces the computation time by 3-4 orders of magnitude compared to a direct implementation of the F-VFM for typical experimental dataset sizes. Reconstruction of stiffness distributions with the FVFM has been validated on several stiffness distribution scenarios, one of which is presented here, in which a difference of about 0.5% was achieved between the reference and recovered stiffness distributions.

Monocular Three-dimensional Self-calibrating Surface Reconstruction using Digital Photogrammetry

In Proceedings of the AUN/SEED-Net Regional Workshop on Mechanical and Aerospace Engineering, Bandung, Indonesia   2008

Authors: Tho T Nguyen, M. Giri Suada, Tatacipta Dirgantara, Ichsan Setya Putra

Photogrammetry, which has significantly matured throughout the years, is an optical technique to accurately measure the depth of spatial points from their images. In this paper, a self-calibrating measurement technique based on photogrammery is presented. A digital camera with zoom lenses is used to capture images of the investigated object. The image sequence is then transferred to a Matlab® code to detect the interest points, then to compute the 3-D coordinates of those interest points and the camera poses by matrix factorization operation. Neither calibration object nor a priori information of the camera is needed. The proposed 3-D reconstruction technique is proved able to measure the 3-D shapes of various surfaces with the error of 1 part in 1000 of their sizes.

Three-dimensional Surface Reconstruction of Aircraft Component using Digital Photogrammetry

In Proceedings of the 2nd Regional Conference on Aerospace Science, Technology and Industry, Bandung, Indonesia   2007

Authors: Tho T Nguyen, M. Giri Suada, Tatacipta Dirgantara, Ichsan Setya Putra

In this paper, the application of photogrammetry to accurately reconstruct threedimensional shape of an aircraft component is presented. This technique, which has matured significantly throughout the years, is originally an optical method to measure distances with high accuracy. In this work, images of the object are taken from several positions using single digital camera. Circular markers are distributed over the surfaces of the object in order to improve the accuracy of the reconstructed object. The accuracy of the reconstruction process is checked by comparing several measurements using caliper with the distance obtained by photogrammetry. The results show that the differences is less than 0.1%.

Organizations

Institution of Mechanical Engineers (IMechE)

Chartered Engineer (CEng) and Member

Certifications

MOOC Oil & Gas Achievement Certificate

IFP School License IFP/OG1/cert4312 June 2015

Tho T Nguyen

PhD CEng MIMechE, Research Associate at Loughborough University

ngtruongtho@yahoo.fr

Contact Tho T on LinkedIn