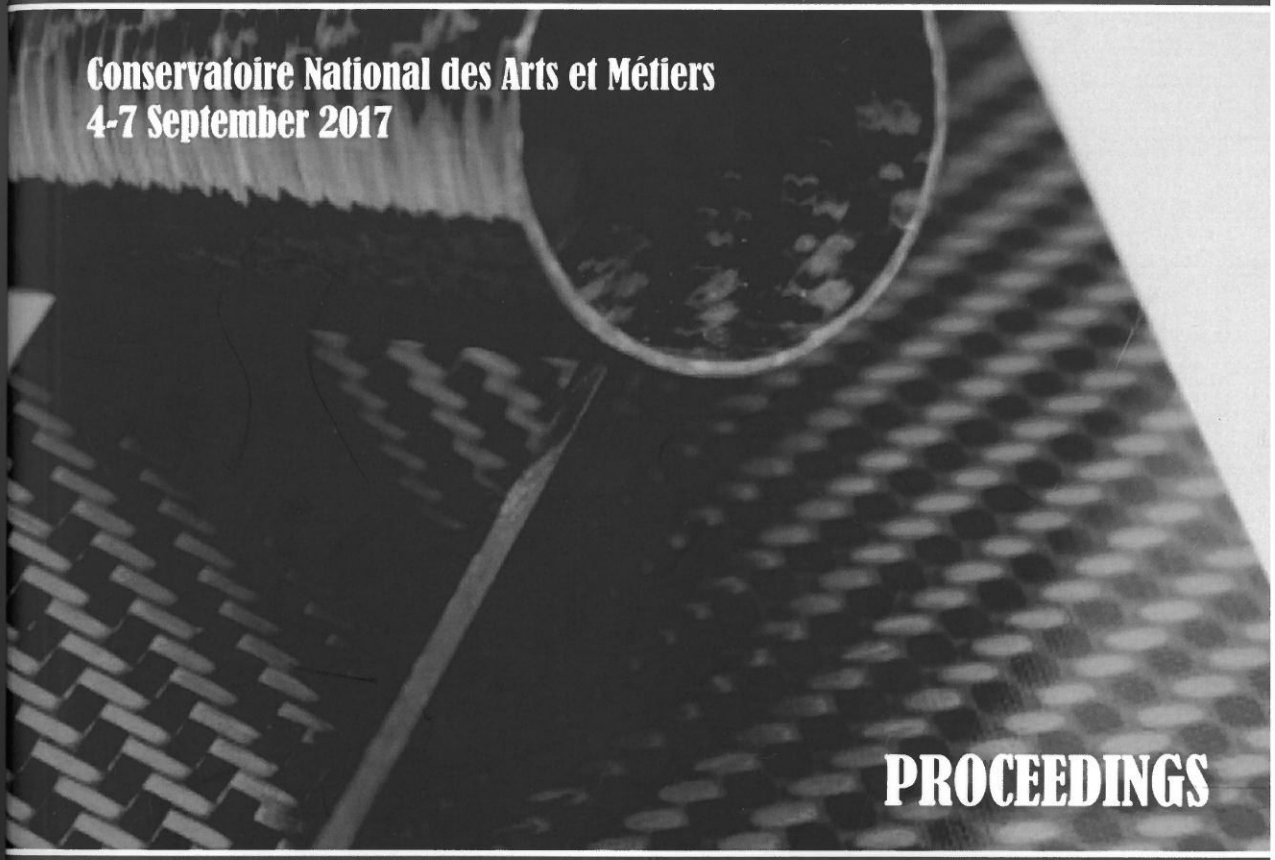
ICCS20

20TH INTERNATIONAL CONFERENCE ON COMPOSITE STRUCTURES

Conservatoire National des Arts et Métiers
4-7 September 2017



PROCEEDINGS

Edited by
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SOCIETÀ EDITRICE ESCULAPIO

energy and the work of a load is defined. Based on the principle of the total potential energy the system of equilibrium equations is derived. Then the system is analytically solved with the use of trigonometric series as formulas for unknown functions. The shear stresses and maximum deflections are obtained. Moreover, the position of the neutral axis is determined. The calculations for the family of beams are realized. The results are presented in Figures and Tables.

485 | Vibration behaviors of fluid-filled single-walled carbon nanotubes based on nonlocal strain gradient models and slip boundary conditions

Wang Jinrui (Kunming University of Science and Technology, China)
Yang Yang (yangyang0416@kmust.edu.cn, Kunming University of Science and Technology, China)

Based on the high-order nonlocal strain gradient theory and slip boundary conditions of nano-scale fluid, the dynamic Euler-Bernoulli beam model for fluid-filled single-walled carbon nanotube (SWCNT) is established. The micro and nano scale effect contribute by SWCNTs and inner fluid are numerically simulated by nonlocal strain gradient terms and fluid-slip-boundary-condition terms, respectively. The governing equations of free vibration for fluid-filled SWCNT beam are derived according to Hamilton's principle, when the fluid slip boundary conditions are considered. By solving the governing equations, the analytical expressions of angular frequency for fluid filled SWCNT beams are obtained, and the influence from nano scale effects on dynamic behaviors of SWCNTs are studied. According to the simulation results, the wave propagation and free vibration are promoted by the nano-scale effect from SWCNTs, when the effects from fluid lead to damping of the dynamic behaviors. The stiffness of SWCNT is enhanced with the increasing fluid velocity. However, the damping of vibration is indicated at high fluid velocity lever.

824 | Strength and leakage development of a flat face bolted GFRP flange joint with rubber gasket using PPNC

Muhsin Aljuboury (muhsin.aljuboury@plymouth.ac.uk, Plymouth University, UK)
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Stephen Grove (Plymouth University, UK)
Richard Cullen (Plymouth University, UK)

The leakage performance of a flat face bolted GFRP flange joint is presented in this study. The investigation is carried out using 3D finite element analysis (FEA) of a bolted GFRP flange joint comprising flange, pipe, gasket and bolts. This model has taken into account the orthotropy of the GFRP material and the non-linear behaviour of the rubber gasket material for both the loading and non-loading conditions. In addition, the pressure-penetration criteria (PPNC) has been used to model the leakage propagation between the flange and the gasket. Furthermore, this type of the joint has been manufactured and it will be tested to get the experimental results. However, in order to validate the FE model of this study, a benchmark test was run against a previously-published experimental and numerical study of a bolted metallic flange joint; the agreement between the results is excellent. Regarding the Finite Element Analysis (FEA), a three dimensional finite element model has been developed for the bolted flange using ANSYS version 18. The model includes flange, gasket and bolt with dimensions and shapes compliant with the ASME Boiler and Pressure Vessel Code, section X. Using symmetry in the geometry, a primary segment is repeated at equally spaced intervals about the axis of symmetry, so 1/16th portion of the total circumference of the flange joint has been considered. This option has been chosen to reduce the total simulation time and computer resources. The manufacturing process involves two main steps; designing the mould and the GFRP flange fabrication. This flange has been bonded to a composite pipe that has been closed from another end by using other type of flange. Also, a blind Acrylic flange, which is clear, has been made to close the GFRP flange and see the leakage propagation during the testing. The results of the finite element analysis show that the distribution of gasket contact stress is non-uniform across the gasket width with minimum values at the inner radius and increasing in the radial direction and around the bolt hole. The leakage propagation at the midpoint between the bolts is larger than at the centres of the bolts. Finally, the finite element method using PPNC is an efficient means to study the leakage behaviour compared to other methods, which are relatively time-consuming and expensive.

Keywords: GFRP bolted flange joint; Leakage development; Fluid pressure penetreation (FPP).

877 | A numerical modeling approach of composite risers for deep waters

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Jianqiao Ye (Engineering Department, Lancaster University, UK)

The current demand for the oil and gas has led to an increase in more technological advancements. Also, this trend has made offshore explorations to move from shallow waters to deep waters. This requires longer risers, resulting in significant weight increase. To improve riser technology, composite materials can be used. They offer advantages that can be harnessed. These include high corrosion resistance, fatigue resistance, high strength characteristics and weight savings since they are lightweight with low bending stiffness. This paper presents a brief overview on the progress made in the research activities on composite risers. This is in response to the marked increase in both the use of offshore composites and the increased research on composite risers. The material development and lay-up configurations used in the modelling approach were presented. Composite materials properties used like AS4/PEEK were also presented with their advantages for applications in deep waters of over 1000m depth. The first time composite risers were successfully deployed offshore was on Heidrun Platform in 1995 as a composite joint. This started the success in the historical trend of composite riser development. This paper also presents the different load conditions for composite risers. It also presents compares study between composite risers and steel risers using indices like strength, fatigue and cost. Lastly, the current recommended practices and standards currently being used in designing composite risers were x-rayed.

701 | A multiaxial, pressure-dependent localisation plane based viscoplastic model for unidirectional fibre-reinforced polymers

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Borja Erice (University of Oxford, UK)
Hao Cui (University of Oxford, UK)
Justus Hoffmann (University of Oxford, UK)
Jens Wiegand (COMPACT Composite Impact Engineering LTD, UK)
Nik Petrinic (University of Oxford, UK)

Significant efforts have been made over the years to develop a series of constitutive models and comprehensive failure criteria for unidirectionally reinforced (UD) FRPs able to explain experimentally observed effects such as multiaxiality, rate-, and pressure-dependency. When it comes to failure criteria for UD FRPs, this field has reached a high level of maturity, with many available criteria able to predict the different existing failure modes with a high degree of accuracy while leaning on strong physical foundations. However, in terms of the nonlinear response, although many constitutive laws have been developed, the majority either: (a) fail to accurately describe all of the main phenomena that have been observed in the experiments; or (b) are at best phenomenological, failing to give meaningful insight into the physical processes behind these effects. In addition, many of these models can be difficult to interpret due to the complexity of their formulations. With all of this in mind, a new constitutive model has been developed that aims to accurately tackle the aforementioned effects, while doing so in a conceptually simple manner and with a strong physical basis. In this model, it is assumed that yielding occurs primarily due to the shear stresses acting on a certain localisation plane, while the normal compressive stress acting on this plane has a strengthening effect similar to the effect of pressure in a Drucker-Prager model. In this way, the orientation of the localisation plane, which depends on the stress state of the material, deals with the issue of multiaxiality and the pressure-dependency is accounted for by the Drucker-Prager based yield criterion. Following the initial yielding of the material, a strain hardening relationship is implemented via a power law calibrated against the nonlinear in-plane shear stress-strain curves. The plastic flow can then be defined as associative or non-associative, in which case a dilatancy coefficient scales down the effect of the normal stress in the non-associative flow rule for the particular localisation plane. Similarly, to the way the multiaxiality and pressure-dependency of the yield criterion are handled, these effects on the nonlinear hardening curves under different types of loads are also inherently derived from the nature of the formulation. The main appeal of this approach is that a complex three-dimensional problem is reduced to essentially a case of 2D plasticity, which is conceptually much simpler and easier to interpret. In addition, this model is supported by a relatively strong physical basis, as it is constructed from well-established building blocks in the Mohr-Coulomb and Drucker-Prager theories. Finally, experimental results are provided that support the hypotheses on which the developed model leans upon and a series of benchmark test cases are compared to in-house and literature experimental data, showing its strong performance.

MONDAY 4 SEPTEMBER (AFTERNOON)
AMPHI ABBÉ-GRÉGOIRE

Modeling in Mechanics and Materials (Chaired by LW Zhang and KM Liew) 1

Chairs: Lu-Wen Zhang (Shanghai Jiao Tong University, China)
K.M. Liew (City University of Hong Kong, Hong Kong)

14h45
158 | Buckling analysis of functionally graded sandwich plates under the effect of mechanical and thermal loads
Dongdong Li (ldd1618@126.com, Nanjing University of Aeronautics and Astronautics, China), Zongbai Deng (Nanjing University of Aeronautics and Astronautics, China), Xiaojing Gong (Institut Clément Ader, IUT Tarbes de l'Université Toulouse III, France), Guoping Chen (Nanjing University of Aeronautics and Astronautics, China), Jia Huang (Institut Clément Ader, IUT Tarbes de l'Université Toulouse III, France)

15h05
452 | Numerical analysis method for vibration of strain gradient plate
Lifeng Wang (walfe@nuaa.edu.cn, Nanjing University of Aeronautics and Astronautics, China), Jingnong Jiang (Nanjing University of Aeronautics and Astronautics, China), Wang Li (Nanjing University of Aeronautics and Astronautics, China), Wei Xu (Nanjing University of Aeronautics and Astronautics, China)

15h25
472 | Prediction of transverse thermal conductivity of plain weave ceramic matrix composites under in-plane loading
Mingming Chen (School of Naval Architecture, Shanghai Jiao Tong University, China), Heyin Qi (Shanghai Jiao Tong University, China), Daxu Zhang (daxu.zhang@sjtu.edu.cn, Shanghai Jiao Tong University, China), Jinghai Gong (Shanghai Jiao Tong University, China)

15h45
824 | Strength and leakage development of a flat face bolted GFRP flange joint with rubber gasket using PPNC
Muhsin Aljuboury (muhsin.aljuboury@plymouth.ac.uk, Plymouth University, UK), Md Jahir Rizvi (Plymouth University, UK), Stephen Grove (Plymouth University, UK), Richard Cullen (Plymouth University, UK)

16h05
877 | A numerical modeling approach of composite risers for deep waters
Amaechi Chiemela Victor (chiemelavic@gmail.com Engineering Department, Lancaster University, UK)
Jianqiao Ye (Engineering Department, Lancaster University, UK)

16h25
895 | An ensemble approach based on electromechanical impedance for identification of IC debonding of FRP strengthened RC structures
Ricardo Perera (ricardo.perera@upm.es, ETSII, Technical University of Madrid, Spain)
Rui Sun (ETSII, Technical University of Madrid, Spain)
Lluis Torres (AMADE, Polytechnic School, University of Girona, Spain)
Hamed Moawad (AMADE, Polytechnic School, University of Girona, Spain)

16h45
592 | Crashworthiness improvement of aircraft fuselage sections using hybrid energy absorbers
Javier, Paz (javier.paz.mendez@udc.es, Universidade da Coruña, Spain), Filipe, Teixeira-Dias (The University of Edinburgh, UK), Luis E., Romera (Universidade da Coruña, Spain), Jacobo, Díaz (Universidade da Coruña, Spain)

17h05
79 | Comparing different approaches to simulate the interaction between CNT and polymer
Roham Rafiee (roham.rafiee@ut.ac.ir, University of Tehran, Iran), Amin Ghorbanhosseini (University of Tehran, Iran), Mohammad Mahdavi (University of Tehran, Iran)

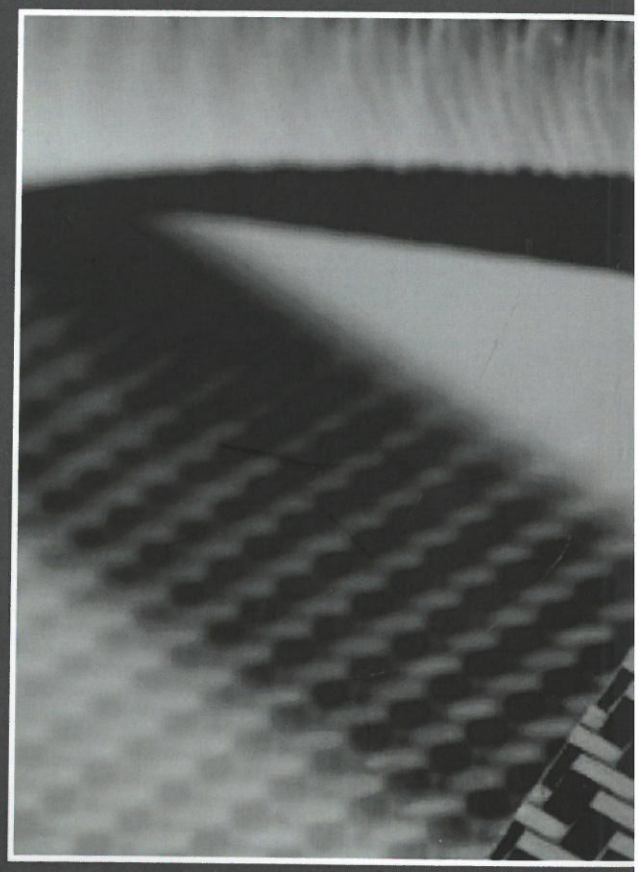
17h30
Cocktail

le cnam

Composite materials have aroused a great interest over the last few decades, as proven by the huge number of scientific papers and industrial progress. The increase in the use of composite structures in different engineering practices justify the present international meeting where researches from every part of the globe can share and discuss the recent advancements regarding the use of structural components within advanced applications such as buckling, vibrations, repair, reinforcements, concrete, composite laminated materials and more recent metamaterials.

Studies about composite structures are truly multidisciplinary and the given contributions can help other researches and professional engineers in their own field. This Conference is suitable as a reference for engineers and scientists working in the professional field, in the industry and the academia and it gives the possibility to share recent advancements in different engineering practices to the outside world. This book aims to collect selected plenary and key-note lectures of this International Conference.

For this reason, the establishment of this 20th edition of International Conference on Composite Structures has appeared appropriate to continue what has been begun during the previous editions. ICCS wants to be an occasion for many researchers from each part of the globe to meet and discuss about the recent advancements regarding the use of composite structures, sandwich panels, nanotechnology, bio-composites, delamination and fracture, experimental methods, manufacturing and other countless topics that have filled many sessions during this conference. As a proof of this event, which has taken place in Paris (France), selected plenary and key-note lectures have been collected in the present book.



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