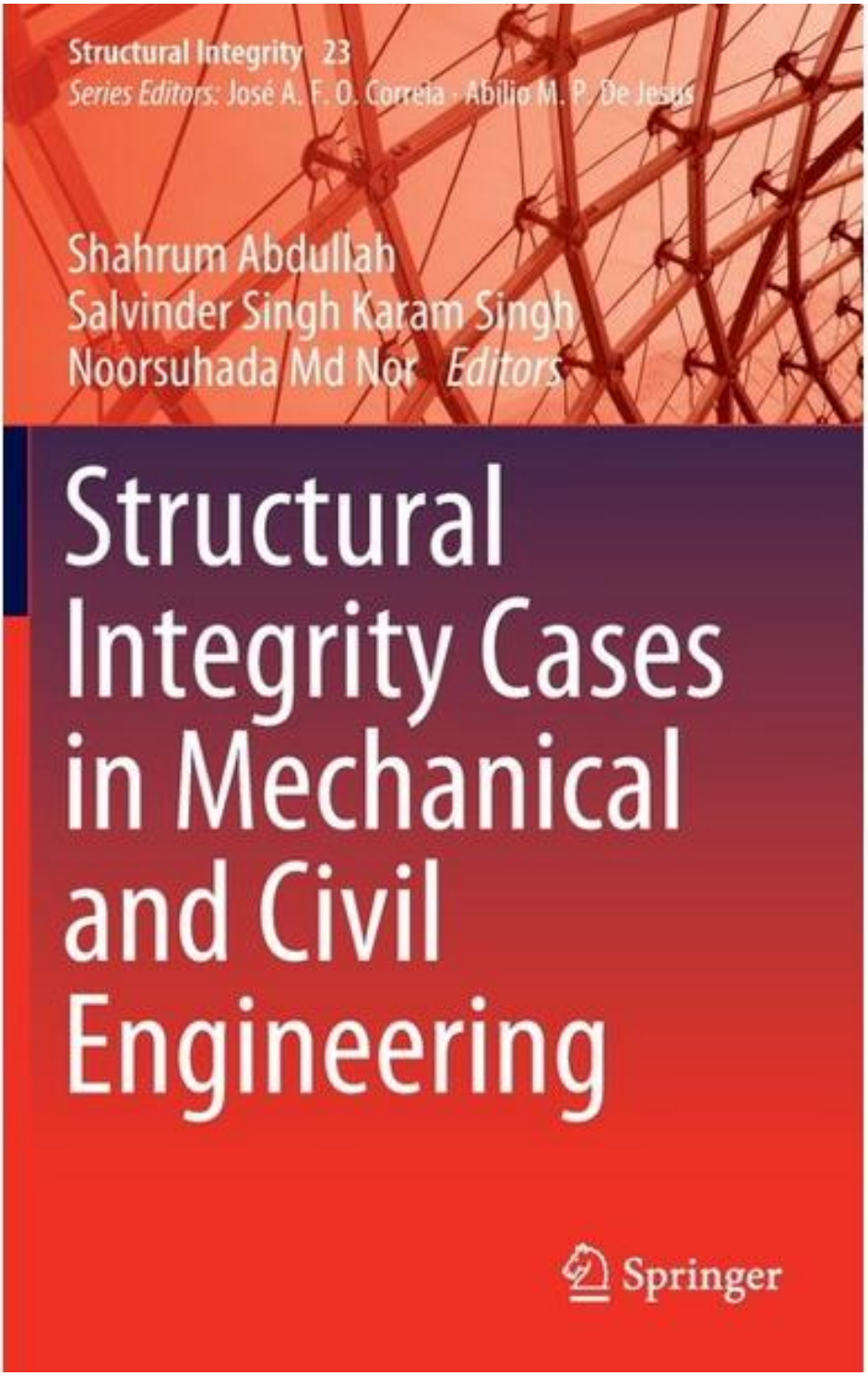

Structural Integrity Cases in Mechanical and Civil Engineering

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Preface

Structural integrity is a scientific area that studies the integrity of a support structure taking into account the structural loads for which the structure was designed, but also taking into account the loads operated during the life of the structure. Besides, this discipline studies past structural failures to be taken into account in structural assessments of existing engineering structures as well as in future designs.

Structural integrity and failure analysis include a set of topics for structural assessments to be developed such as: structural integrity, failure analysis, structural durability, degradation and conservation of materials and structures, dynamic and seismic structural analysis, fatigue and fracture of materials and structures, risk analysis and safety of materials and structural mechanics, fracture mechanics, damage mechanics, analytical and numerical simulation of materials and structures, computational mechanics, structural design methodology, experimental methods applied to structural integrity, multiaxial fatigue and complex loading effects of materials and structures, fatigue corrosion analysis, scale effects in the fatigue analysis of materials and structures, fatigue structural integrity, structural integrity in railway and highway systems, sustainable structural design, structural loads characterization, structural health monitoring, adhesives connections integrity, rock and soil structural integrity, etc.

The 5th Symposium on Damage Mechanism in Materials and Structures (SDMMS 2021) took place in Universiti Teknologi MARA, Cawangan Pulau Pinang, Malaysia on 8–9 March 2021. This symposium provided a venue for researchers and engineers in damage mechanisms in the materials and structures field from academia, industry, and government to meet in a forum where the latest research results are presented and prospects for future developments are discussed. The symposium was organized by the Universiti Teknologi MARA (UiTM) Cawangan Pulau Pinang, Faculty of Civil Engineering and Universiti Kebangsaan Malaysia (UKM), Computational and Experimental Mechanics (CEM) Research Group. This event was the fifth in a series of conferences that started in August 2016, Malaysia. The 1st Symposium on Damage Mechanisms in Materials and Structures (SDMMS), 2016, was organized by the Universiti Kebangsaan Malaysia (UKM), Centre for Automotive Research (CAR),

Faculty of Engineering and Built Environment, Malaysian Association of Computational Mechanics (MACM), and Universiti Malaysia Perlis (UniMAP). The 2nd Symposium on Damage Mechanisms in Materials and Structures (SDMMS), 2017, took place in Hotel Bangi-Putrajaya, Bandar Baru Bangi, Selangor on October 24th, 2017. The 3rd SDMMS were held in Hotel Bangi-Putrajaya, Bandar Baru Bangi, Selangor, in 2018. The 4th SDMMS which were held in Hotel Bangi-Putrajaya, Bandar Baru Bangi, Selangor on October 20–22th, 2019.

This volume of the Structural Integrity series with 24 chapters covers the subject related to the damage mechanism and structural integrity in the scope of mechanical engineering and civil engineering. Thus, the failure pattern of various materials and structures in both engineering filed was agreed upon as the main subject matter for the discussion. The topics approached are in the scope of fatigue damage, fatigue crack initiation and propagation, life prediction techniques, computational fracture mechanics, dynamic fracture, damage mechanics and assessment, Non-Destructive Test (NDT), concrete failure assessment, failure on soil structures, structural durability and reliability, structural health monitoring, construction damage recovery, and any relevant topics related to failure analysis. The book is suitable for those who involve in this field, such as academicians, engineers, practitioners, students, and researchers. They are the main players who want to obtain an up to date view of the recent advances in the area of damage mechanisms in both the engineering field of mechanical and civil.

The keynote lectures of the 5th SDMMS 2021 were given by: Prof. Ir. Dr. Ahmad Kamal Ariffin Mohd. Ihsan of the Universiti Kebangsaan Malaysia, Malaysia; Associate Prof. Dr. Wonsiri Punurai of the Mahidol University, Thailand; lr. Hambali Chik of the Petroliam Nasional BerhaD (PETRONAS); Dato' Ir. Dr. Goh Teik Cheong of the M.E.I. Project Engineers Sdn Bhd; and Dr. Musa Bashir of the Liverpool John Moores University, England.

The chairman of the 5th SDMMS, Prof. Shahrum Abdullah (Universiti Kebangsaan Malaysia), acknowledges all authors who have contributed to the success of the event and their contributions to this volume dedicated to the structural integrity cases in civil and mechanical engineering, as well as the organizers, sponsors, scientific committee for their support. Also, Springer is fully acknowledged for its support to this volume.

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Contents

Fatigue Detection on Glass Fibre Reinforced Polymer Material Using Fiber Bragg Grating Sensor

Miminorazeansuhaila Loman & Mohd Hafizi Zohari

Conference paper | First Online: 24 January 2022

Part of the Structural Integrity book series (STIN,volume 23)

Abstract

The effectiveness of monitoring systems for composite materials is improving owing to their increasing utilisation. Abrupt failure in composite requires an effective detection method and monitoring system. The fibre Bragg grating (FBG) sensor is one of the alternative sensors used for detecting and monitoring the structural health of an engineering structure. This study evaluated the applicability of the FBG sensor for fatigue damage monitoring in the composite. This study involved composite fabrication and experimental work. The glass fibre reinforced polymer specimens were fabricated using fibre glass and resin and made into flat workpieces. The workpieces were then utilised in a series of fatigue tests. Prior to the fatigue test, tensile tests were conducted to verify the ultimate strength of the material. Commencement of fatigue tests were recorded using the FBG sensor. Once the tests were started, the signals were acquired using the FBG sensor simultaneously. Data acquisition was continued during the fatigue test progression until the specimen failed. Results show the FBG wavelength shifted from its original position during tension loading and whenever the composite was released to its original position in the cyclic test. The FBG sensor seems a promising way to monitor fatigue damage and can be utilised in fatigue monitoring. Its wavelength shifts or changes is capable to monitor fatigue damage progression effectively.

Keywords

Fatigue | Fibre bragg grating | Composite

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