PULSE CODING TECHNIQUE

for Fiber Bragg Grating Sensor

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Preface

Praise be to Allah SWT, the lord of the world. Blessings and salutations to the Prophet Muhammad PBUH, thanks to Allah SWT, with His permission, we were able to complete a scientific book entitled PULSE CODING TECHNIQUE FOR FIBER BRAGG GRATING (FBG) SENSOR. The book is successfully produced with the best level of quality and with a mature writing style. It is hoped that this book will be of interest to students, researchers, and related bodies.

Our gratitude and appreciation are dedicated to the Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia and the companions who have helped in the writing of this book. We would also like to thank Nurul Ayni Mat Pauzi for helping in helping the final editing of this book. Every service and dedication will be remembered forever. Only God can repay all the good deeds that have been done. May God bless us and bless all that we have worked for during the completion of this book.

The book is produced based on a thesis titled "Code Division Multiplexing Technique in Fiber Bragg Grating Sensor". It consists of seven chapters which cover the analysis on the deployment of code division multiplexing techniques to improve the overall performance of TDM-FBGs for strain and temperature measurements. This includes the experimental deployment of a new coded TDM-FBG based on hybrid simplex and Golay codes. The book is organized as follows:

Chapter 1 shares the history of the development of Optical Fiber Sensor and the issues with TDM-FBG which is our focus in this research, and the aim and goals of this book. Chapter 2 and 3 shares on multiplexed FBGs in the field of distributed measurements are explained. Starting by briefly introducing other multiplexing techniques, reaching to deep investigation explaining TDM-FBGs aspects. The main performance requirements for TDM-FBG systems such as multiplexing ability, spatial resolution, active dynamic range, and measurements sensitivity are introduced in this section. Consecutive signal-to-noise improvement methods are fully distributed at the end of this chapter, followed by their

critical review. Including the conceptual and mathematical analysis of conventional accumulative signal averaging, simplex codes Golay complementary codes and hybrid simplex/Golay coding technique.

Part of Chapter 4 provides the proof-of-concept verification of the proposed technique that is used in this research, where the performance of Golay coded TDM-FBG is experimentally investigated extensively. Furthermore, the experimental verification of simplex coded TDM-FBG is provided in detail. This chapter also illustrates the assets and the liabilities of the individual use of each technique, providing the groundwork for proposing both techniques in one hybrid approach.

Chapter 5 discusses the proposed hybrid coded sequences to improve the overall performance of the conventional GCCs. In the previous two chapters, a new proposal to incorporate TDM-FBG sensors with GCC technique was simulated and experimentally verified. Thus, optimizing the conventional GCC sequences performance is theoretically and experimentally demonstrated.

Chapter 6 discusses in detail the study methodology, where the fundamentals and the simulations of conventional and coded TDM-FBG are illustrated. The chapter introduces the combination of the two simulation tools of OptiSystem and OptiGrating at first. Moving through preliminaries such as the deployment of wavelength division multiplexing FBG (WDM-FBG) sensor of cross sensitivity free deployment and the single pulsed strain measurement TDM-FBG array. This variety of simulative results is concluded by the design, and the performance analysis of Golay coded TDM-FBG for strain measurements.

Chapter 7 concludes the research findings and contributions of the proposed studies. This chapter also presents the recommendations for future work.

Reading, research and curiosity towards science and engineering are the key to success for new technologies to be established and developed in Malaysia. We would also like to thank the UKM publication for successfully publishing this book as part of the national knowledge asset.

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