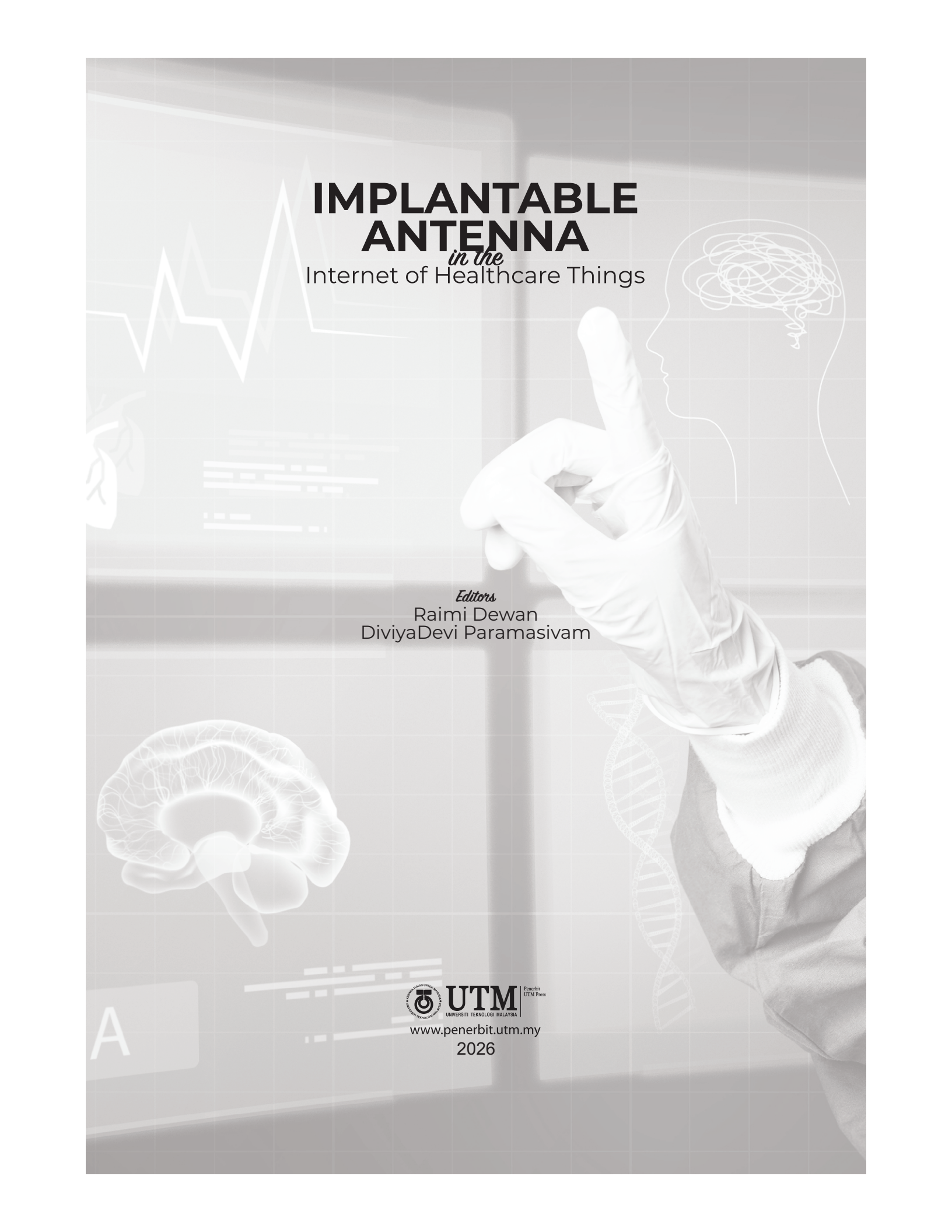


IMPLANTABLE ANTENNA

in the
Internet of Healthcare Things



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Editors

Raimi Dewan
DiviyaDevi Paramasivam



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PREFACE

The healthcare landscape is undergoing a profound technological revolution, driven by the rapid integration of intelligent and connected systems known as the Internet of Healthcare Things (IoHT). These systems are transforming conventional medical practices into data-driven, predictive, and patient-centered models of care. This book, *Implantable Antenna in the Internet of Healthcare Things*, provides an in-depth exploration of one of the most critical enablers of IoHT, the implantable antenna, which serves as the wireless interconnection between the human body and the digital healthcare ecosystem.

The purpose of this book is to consolidate recent advancements in implantable antenna design, analysis, and biomedical applications. It presents a structured and progressive journey for readers, beginning with the fundamental concepts of IoHT and leading toward specialized antenna technologies used in implantable medical devices. These include pacemakers, neurostimulators, glucose monitors, and biotelemetry sensors that allow seamless data communication from within the body. By integrating multidisciplinary knowledge from biomedical engineering, materials science, wireless communication, and data analytics, this work provides a holistic perspective on how implantable antennas are shaping the future of healthcare innovation.

Our motivation stems from the increasing demand for reliable, miniaturized, and biocompatible communication systems capable of operating safely within the human body. With global populations aging and chronic diseases on the rise, healthcare systems are facing immense pressure to provide continuous, personalized monitoring. Implantable antennas address this challenge by enabling real-time physiological data collection, remote diagnostics, and personalized therapy, paving the way

for preventive and precision medicine. Through this work, we aspire to contribute to the development of intelligent healthcare systems that enhance diagnostic accuracy, improve treatment outcomes, and elevate the quality of life for patients worldwide.

This book is written for postgraduate students, academic researchers, engineers, and healthcare professionals interested in the design and application of wireless medical technologies related to biomedical application. It assumes a foundational understanding of electrical and electronic engineering, as well as an enthusiasm for multidisciplinary collaboration that bridges health sciences, and communication technologies. We also hope it serves as a reference for policymakers and industry professionals seeking to understand the technological underpinnings of next-generation medical devices.

The chapters are designed to provide a coherent progression from theoretical principles to applied research. Chapter 1 introduces the concept of IoHT and biotelemetry systems, highlighting their evolution and significance in modern healthcare. Chapters 2 through 4 focus on implantable antenna design, including their interaction with human tissues, material and structural considerations, and performance evaluation parameters. Chapter 5 explores the role of implantable medical devices in biotelemetry applications, emphasizing real-world integration and communication strategies. Chapter 6 concludes with a case study on coplanar waveguide circularly polarized antennas used in breast implant applications, demonstrating how theory translates into practical innovation.

We would like to extend our heartfelt gratitude to our colleagues, research collaborators, and students whose curiosity, dedication, and contributions have enriched this work. We also wish to acknowledge the invaluable support of the Ministry of Higher Education (MOHE), the School of Postgraduate Studies (SPS), the Research Management Centre (RMC), the Advanced Radio Frequency (RF) and Microwave Research Group, the IJN-UTM Cardiovascular Engineering Centre, and Universiti Teknologi Malaysia (UTM), Johor Bahru, for their support of this research under the Fundamental Research Grant Scheme FRGS/1/2023/TK07/

UTM/02/23 and the UTM Fundamental Research Grant Q.J130000.3823.24H07.

It is our sincere hope that *Implantable Antenna in the Internet of Healthcare Things* serves not only as an academic reference but also as an inspiration for continued innovation at the intersection of healthcare and communication technology. We envision a future where implantable systems are not merely tools of treatment, but trusted companions in sustaining human health, wellbeing, and life itself.

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