出國報告 **(出國類別：國際會議)**

參加 PIERS 2014
國際學術研討會議

服務機關：國立虎尾科技大學 飛機工程系

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派赴國家：中國大陸

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報告日期：2014/10/01

摘要

PIERS 2014 (Progress in Electromagnetics Research Symposium)是全球電磁領域非常重要之國際學術研討會。本年度在廣州市舉辦，研討會為期四天(8/25 – 8/28)，規模非常盛大，共有超過 2000 篇文章投稿。今年適逢 Maxwell 方程式發表 150 週年，大會特別安排相關場次，讓研討會更具特色。除了積極參與各個不同主題場次的論文發表外，我們也發表一篇專業論文(Path loss of radio propagation in an aircraft cabin)，論文內容探討無線電波在機艙內的傳遞損失，包括機艙設施以及乘客對電波傳遞的影響。

參加此次研討會除了發表自己近期的研究成果並與來自世界各地的專家學者面對面討論外，同時也吸收目前最新的研究主題與方向。另外，也可以一睹國際知名學者的風采及研究精神，雖然只是短暫的時間，但卻受益良多。

目次

壹、目的

本次出國之首要目的為發表近期之研究論文，並經由與世界各地學者專家即時地討論互動，進而強化我們的研究成果。其次，藉由參與國際研討會，所有最新的研究成果與主題，均可以在短短幾天的會期內做一個快速地瀏覽。而大會提供的資料更是非常寶貴的參考資料，對於未來的研究將有莫大的助益。最後，在會場中可以認識各國的研究人員與專業人士，除了擴展本身的研究視野，並可增進與國內外學者的交流機會。此外，也可進行國民外交，讓各國人士認識台灣，提升台灣的國際知名度。

基於上述之目的，PIERS 2014 (Progress in Electromagnetics Research Symposium)為我們所選擇參與的研討會。首先，PIERS 2014 包含了所有電磁相關之各個研究領域，參與此研討會必可接觸到各領域的最新發展狀況，提升本身的研究能力。PIERS 2014 有超過 2000 篇論文投稿，參與之研究人員眾多，各個領域、各個國家與地區及各個年齡層的研究人員皆有，參與此一會議除了專業上的學術研討外，也可認識許許多多的朋友，達到專業與人文之雙向交流。

貳、過程

PIERS 2014 (Progress in Electromagnetics Research Symposium) 在廣州朗豪酒店舉辦，該酒店為一新穎的五星級飯店，會議空間廣闊，也才足以容納此種大型研討會。

一、 議場主題

會議共分成五大主軸：

1. Computational Electromagnetics, Electromagnetic Compatibility, Scattering and Electromagnetic Theory.
2. Metamaterials, Plasmonics and Complex Media.
3. Optics and Photonics.
4. Antennas and Microwave Technologies.
5. Remote Sensing, Inverse Problems, Imaging, Radar and Sensing.

大會安排的 Plenary Session 共邀請了 5 位傑出的講者，分別是：

演講者	單位	主題
Prof. Sir John Pendry	Imperial College London, UK	Metamaterials
Prof. David Miller	Stanford University , USA	Low-energy Integrated Photonics for Information Processing
Prof. Akira Ishimaru	University of Washington, Seattle, USA	Statistical Electromagnetic Theories Applied to Imaging in Geophysical and Biological Random Media
Prof. Federico	Harvard University, USA	Flat Optics Based on

Capasso		Metasurfaces: Molding Wavefronts and Surface Waves
Prof. Lihong Wang	Washington University in St. Louis, USA	Photoacoustic Tomography: Ultrasonically Beating Optical Diffusion and Diffraction

大會也安排主題為：Photovoltaics LEDs and Other Optoelectronics in Energy 以及 Microwave Photonics 兩個 mini-symposia。此外，為了紀念 Maxwell 方程式 150 週年，大會特別安排一個 sesquicentennial anniversary session，邀請電磁領域 9 位傑出資深學者發表演說。

二、 會議議程

會議期間自 8/25 起至 8/28 止共 4 天，詳細議程參考如下 4 頁。我們的論文發表時間為 8/27 下午。

三、 報告議題

我們發表的論文主題為：Path loss of radio propagation in an aircraft cabin，由於新一代飛機配備有各式各樣導航、通訊等設備，因此飛機上電波傳遞的特性逐漸成為一個有趣的研究課題。而飛機乘客所使用的個人行動裝置與飛機航電系統的耦合效應更是一個值得重視的議題。論文內容探討無線電波在機艙內的傳遞損失，包括機艙設施以及乘客對電波傳遞的影響。首先用 CST 模擬軟體進行模擬，我們以 T39-A 機型建立電磁模型，模擬 330MHz 電磁波由機艙內的天線傳遞到機艙外天線所造成的 path loss。模擬結果顯示，飛機上的乘客對電波傳輸會有顯著的影響。此外，為了驗證模擬結果的正確性，將進一步進行實際量測。論文摘要請參見附錄。

	MONDAY AM 8:00 August 25	MONDAY PM 13:00 August 25		TUESDAY AM 8:00 August 26	TUESDAY PM 13:00 August 26	
ROOM 1	1A1 - Plenary Session	1P1 - Casimir Effect and Heat Transfer		2A1 - Education for Electromagnetics	2P1 - Advances in Multiscale, Multiphysics Computation	
ROOM 2	1A1 - Plenary Session	1P2a - Integrated Microwave Photonics	1P2b - Solid-state Quantum Photonics	2A2 - Focus Session on Radio-over-Fiber Systems	2P2a - THz Metamaterials and Applications	2P2b - Optical Microcavities in Biosensing
ROOM 3		1P3a - Inorganic & Semiconductor Photovoltaics	1P3b - Light Management for Photovoltaics	2A3 - Organic and Hybrid Solar Cells 1	2P3a - Organic and Hybrid Solar Cells 2	2P3b - Graphene Photovoltaics
ROOM 4		1P4a - Plasmonic Nanophotonics 1	1P4b - Nano-focusing and Applications	2A4 - Plasmonic Nanophotonics 2 --- Design, Modeling and Simulation	2P4 - Wave Manipulations by Metasurfaces	
ROOM 5		1P5 - Tunable and Reconfigurable Metamaterials and Plasmonics 1		2A5 - Transfromation Optics 1	2P5a - Thermal and Acoustic Metamaterials	2P5b - Optical Metamaterials and Applications
ROOM 6		1P6 - Photoacoustic Tomography and Sensing		2A6 - Disordered Photonics	2P6 - Biophotonics --- Clinical and Preclinical Applications	
ROOM 7		1P7 - Nonlinear Optics: Structured Materials, Functional Devices and Applications 1		2A7 - Optical Resonances and Microresonators	2P7a - Advanced Micro-/Nano-fabrication for Optical Sensing and Imaging Applications	2P7b - Nonlinear Optics: Structured Materials, Functional Devices and Applications 2
ROOM 8		1P_8a - Plasmonic, Metallic, or Dielectric Nanolasers	1P_8b - Semiconductor Lasers	2A8 - Effective Medium Theories and Homogenization	2P8 - Light Harvesting for Energy and Optoelectronic Applications	

	MONDAY AM 8:00 August 25	MONDAY PM 13:00 August 25		TUESDAY AM 8:00 August 26		TUESDAY PM 13:00 August 26	
ROOM 9		1P_9a - Functional Optical Fiber Devices	1P_9b - Integrated Nanophotonics for Optical Interconnects in Data Centers	2A_9 - Optical Fiber Sensing Devices		2P9a - Fiber Optic Sensing Technologies for Structural Health Monitoring and Applications	2P9b - Ultrasensitive Optical Sensors
ROOM 10		1P_10a - Advances in Optical Networking: Parts 1	1P_10b - Onchip Multiplexing Tech. and Devices for Optical Interconnects	2A_10 - Advances in Optical Networking: Parts 2		2P10a - Physics and Applications of Photonic Crystals, Materials, and Nanostructures	2P10b - Photonic Crystals
ROOM 11		1P_11 - Recent Progress on Magnetic and Multiferroic Materials		2A_11a - Recent Advances in Magneto-impedance Sensors	2A_11b - Advanced Magnetic Materials for Microwave Applications	2P11a - Computational Techniques in Electromagnetics and Applications	2P11b - Electronics and Optoelectronics Using Two-dimensional Materials and Their Heterostructures
ROOM 12		1P_12a - Si-based Microwave Devices and ICs	1P_12b - Specialty Optical Fibers: Design, Applications, Devices, and Process	2A12 - Array Antenna for Wireless Communication		2P12 - Compact Microwave Filters	
ROOM 13		1P_13a - Optimal Antennas	1P_13b - THz Antennas and Systems	2A13 - Wireless Power Transfer		2P13a - Progresses in Monolithic and Multilayer/Planar IC & Components	2P13b - Reconfigurable Antennas
ROOM 14		1P_14a - Inverse Problems: Theories, Computations, and Applications	1P_14b - Microwave Imaging: Detection, Localization and Profiling	2A14 - Remote Sensing		2P14a - Remote Sensing of the Atmosphere, Ocean, Hydrology and Cryosphere	2P14b - Synthetic Aperture Radar Imaging and Advanced Radar Techniques
ROOM 15		1P_15a/b/c - Oral Presentations for Best Student Paper Awards		2A15a - Oral Presentations for Best Student Paper Awards -- Optics and Photonics	2A15b - Oral Presentations for Best Student Paper Awards -- Metamaterials, Plasmonics	2P15 - High-speed Optical Communications and Advanced Optical Signal Processing	
ROOM FOYER		1P0 - Poster Session 1		2A0 - Poster Session 2		2P0 - Poster Session 3	

	WEDNESDAY AM 8:00 August 27		WEDNESDAY PM 13:00 August 27		THURSDAY AM 8:00 August 28		THURSDAY PM 13:00 August 28	
ROOM 1	3A1 - Sesquicentennial Commemoration Session for Maxwell's Equations 1		3P1a - Sesquicentennial Commemoration Session for Maxwell 2	3P1b - Plasmonics: Beyond Local-response Dynamics	4A1 - Real-time High-speed Measurements for Communication, Biomedical & Industrial Appl.		4P1 - Nanoparticle-assisted Bioimaging and Sensing	
ROOM 2	3A2 - Focus Session on Microwave Photonics Components and Systems		3P2 - Photonics and Optoelectronics in Industry		4A2 - Design and Simulation of Electromagnetic and Optical Devices 1		4P2a - Design and Simulation of Electromagnetic and Optical Devices 2	4P2b - Optoelectronic and Photonics Devices
ROOM 3	3A3a - Light Emtting Diodes	3A3b - Organic Light Emitting Diodes 1	3P3 - Organic Light Emitting Diodes 2		4A3 - Organic Transistors/Integrated Circuits and Dye-sensitized Solar Cells		4P3a - Fano Resonance in Nanoscale Structures	4P3b - Nanophotonics: Design of Nano-devices and Interaction with Molecules
ROOM 4	3A4 - Tunable and Reconfigurable Metamaterials and Plasmonics 2		3P4 - Graphene for Plasmonics and Sensing		4A4 - Plasmonics for Sensing Applications		4P4a - Science and Applications of Electromagnetic Vortices and OAM	4P4b - Optical Imaging for Biomedical Appl., Spectroscopic and THz BioEM
ROOM 5	3A5 - Microwave Metamaterials 1		3P5a - Functional Chiral Metamaterials	3P5b - Structured Light	4A5 - Transfromation Optics 2		4P5 - Microwave Metamaterials 2	
ROOM 6	3A6 - Laser Spectroscopy for Sensing and Environmental Monitoring 1		3P6a - Subwavelength-focusing and Super Resolution Imaging 1	3P6b - Nonreciprocal Electromagnetics and Photonics	4A6 - Novel Techniques for Subwavelength-focusing and Super Resolution Imaging 2		4P6a - Laser Spectroscopy for Sensing and Monitoring 2	4P6b - Optical Polarization and Coherence in the Near-field Range
ROOM 7	3A7 - Optical Signal Processing		3P7a - Liquid Crystals	3P7b - Advanced Display Technologies	4A7 - High Power Fiber Lasers 1		4P7a - High Power Fiber Lasers 2	4P7b - High Speed Interconnects for High Performance Computing
ROOM 8	3A8 - Luminescent Materials, Devices and Application		3P8 - Zero-index Media, Extremely Anisotropic Media, and Nonlocal Photonic Media		4A8a - Plasmon Enhanced Light-matter Interactions	4A8b - Photonics-applied Electromagnetic Measurement	4P8 - Characterization, Propagation and Application of Beams with Controlled Polarization, Coherence and Phase	
ROOM 9	3A9 - Quantum Optics		3P9a - Photonic Crystal and Multi-material Fibers	3P9b - Fibers and Fiber Devices for Optical Communications	4A9 - Ultrafast Optics		4P9 - Microwave and Millimeter Wave Circuits and Devices, CAD	

	WEDNESDAY AM 8:00 August 27		WEDNESDAY PM 13:00 August 27		THURSDAY AM 8:00 August 28		THURSDAY PM 13:00 August 28	
ROOM 10	3A10a - Nanoimprint and Applications	3A10b - Heterogeneous Photonic Integration Technologies and Devices on Silicon	3P10a - Chaotic/Random Lasers and Their Applications	3P10b - Spectroscopy and Nanoscopy for Sensing and Imaging	4A10 - Nanoantennas		4P10 - Antenna and Array 2	
ROOM 11	3A11 - Advanced Mathematical and Computational Methods in Electromagnetic Theory and Their Applications		3P11a - Microwave and Millimeter-wave Measurements and Sensing	3P11b - Novel Materials and Technologies for Microwave Components	4A11 - Advanced Numerical Techniques in Computational Electromagnetics		4P11a - Novel Mathematical Methods in Electromagnetics	4P11b - Computational Electromagnetics
ROOM 12	3A12 - Novel Frequency Selective Structures		3P12a - MIMO Systems and Applications	3P12b - Antenna-channel Interactions and Multipath Wireless Channels	4A12 - Extended/Unconventional Electromagnetic Theory, EHD/EMHD, and Electro-biology		4P12 - Antennas, Shielding, HPEM and EMC Measurement	
ROOM 13	3A13a - Graded Index Structures and Metamaterials for Antenna Applications	3A13b - Antenna and Array 1	3P13a - Advanced Antenna Theory and Techniques	3P13b - RFID Antennas	4A13a - Remote Sensing of the Earth, Ocean, and Atmosphere	4A13b - Metamaterials for Antenna Applications: Practical Solutions		
ROOM 14	3A14 - Inverse Problems, Diagnostics, and Estimation		3P14 - Application/Effects of EM Field/Radiation in Medicine/Bio and in Ecological Industrial Technologies					
ROOM 15	3A15 - SCNU Special Session on Biophotonics --- Analytical Biophotonics		3P_15a - SCNU Special Session on Biophotonics --- Biophotonics Imaging	3P_15b - Antennas and RF Devices Based on Superconductors				
ROOM FOYER	3A0 - Poster Session 4		3P0 - Poster Session 5					

參、 心得與建議

一、 PIERS 國際研討會原本就已經涵蓋大部分電磁相關之研究主題，每年均有非常多創新的論文在此發表。雖然微波與光波均遵循 Maxwell 方程式，但是以往微波社群與光波社群鮮少有互動。適逢 2014 為 Maxwell 方程式發表 150 週年， PIERS 2014 特別企劃讓兩個社群在會議中互動，期能激發出燦爛的火花。非常高興可以參加 PIERS2014 國際研討會，除了在自己鑽研的領域與國際學者專家交流，更接觸到跨領域的創新發展趨勢，是一個相當值得參與的國際研討會。

二、 從本次 PIERS 2014 國際研討會出席的學者專家及發表的論文中發現，大陸學者投入電磁相關領域研究的人數非常多，成果也非常豐碩。可以預見的，大陸想要從原本世界的工廠，專門從事生產代工這種比較低科技之產業，進一步提升為高科技之品牌大廠，最重要所必需的高科技人力資源應該很快即可具備，此將對國內產業及國人就業造成相當深遠之影響，值得國人提早因應。

三、 我們的論文已完成機艙模型建立並以數值軟體進行模擬，同時也實際進行量測，驗證模擬結果的正確性。未來將針對模擬與實測的誤差，進一步修正，期能建立更精確之模型。

四、 第一次踏上大陸的土地，心中難免有一份奇特的感覺。對廣州的感覺，幾乎各種硬體設施已經和台灣差不多，有大型的白雲國際機場、有俗稱小蠻腰的摩天高塔地標廣州塔、也有四通八達非常方便的捷運系統，但是在精緻度上則和台灣還有一點距離。相較之下，人文素養是台灣遠勝於大陸的主要地方，觀察台灣的高鐵、捷運，乘客幾乎都會排隊上下車，但在廣州，排隊只有在列車未進站前有效，車一進站人們便蜂擁而上，加上廣州的人口密度很高，一開始還真是不太適應。不過大陸官方也開始加強宣導，處處可以看到海報、標語及廣播，教育人民要提升本身的文明。很明顯的，

在捷運上，雖未標示博愛座但只要老弱婦孺上車，馬上都有人讓位，顯見多加宣導還是會有成效。倒是國內有少數人誤解民主的真諦，造成少數違反法律或秩序的個案偶而出現，甚至影響台灣的國際形象，實在可惜。

五、 國內電磁相關研究，無論是理論或實務方面均有雄厚的基礎，去年也承辦 PIERS 2013 in Taipei。建議政府及國內產業可以繼續給予支持，讓國內的相關研究可以繼續發揚光大。

附件：

論文摘要

Progress In Electromagnetics Research Symposium Abstracts, Guangzhou, China, August 25–28, 2014 1665

Path Loss of Radio Propagation in an Aircraft Cabin

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Abstract— Presently, there is much interest in studying characteristics of wave propagation for a modern aircraft since a large number of navigation, data, and communication systems are usually applied to such aircrafts. Considering use of the personal mobile devices in the modern aircraft is feasible and thus the electromagnetic coupling effect between the personal mobile system and the avionic system has to be avoided. The problem of how to determine the path loss from a personal mobile device radiating in the cabin with a number of passengers becomes important and therefore, the purpose of this research is to establish a numerical model for precisely analyzing the path loss caused from the transmitter inside an aircraft cabin to exterior fuselage antenna. The electromagnetic software CST, base on finite-difference time-domain (FDTD), was applied for the required calculation. An electromagnetic model based on a small civil aircraft T39-A and the passengers was then built for theoretical analysis (Fig. 1). The simulated results of electromagnetic signal loss caused from the location of in-cabin antenna and the passengers when the signal, which operates at around 330 MHz, is transmitted from the antennas situated at the seats in cabin to that situated at the exterior fuselage are presented and discussed. The result shows that exist of the passengers significantly affects wave propagation in the cabin. In addition, to verify the simulation results obtained from the developed simulation model, measurement achieved from the real aircraft platform has also been set up and done. Finally, comparison between simulation and measurement has also been examined.

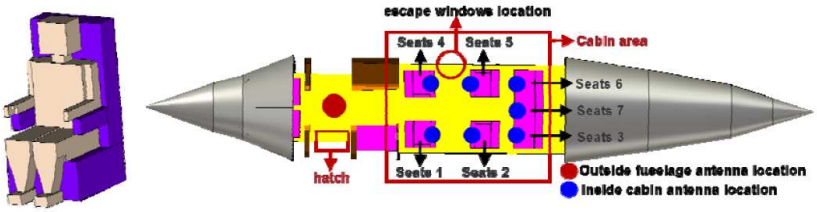

Figure 1: Numerical model of the aircraft and passengers.

ACKNOWLEDGMENT

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Path Loss of Radio Propagation in an Aircraft Cabin
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Abstract
I. Introduction
II. Numerical Model
III. Results
3.1 Case Without Passengers
3.2 Case with Passengers
IV. Conclusion
References

發表論文