藉雙層線圈架構之高效率四線圈無線傳能於深腦電刺激研究

Efficient Four-Coil Wireless Power Transfer by Using Dual-Layer Coil Structures for Deep Brain Stimulation

國立成功大學 電機工程研究所 儀器系統與晶片組
無線創新系統及應用電磁實驗室
(**Wireless Innovation System and EM-applied Lab**)

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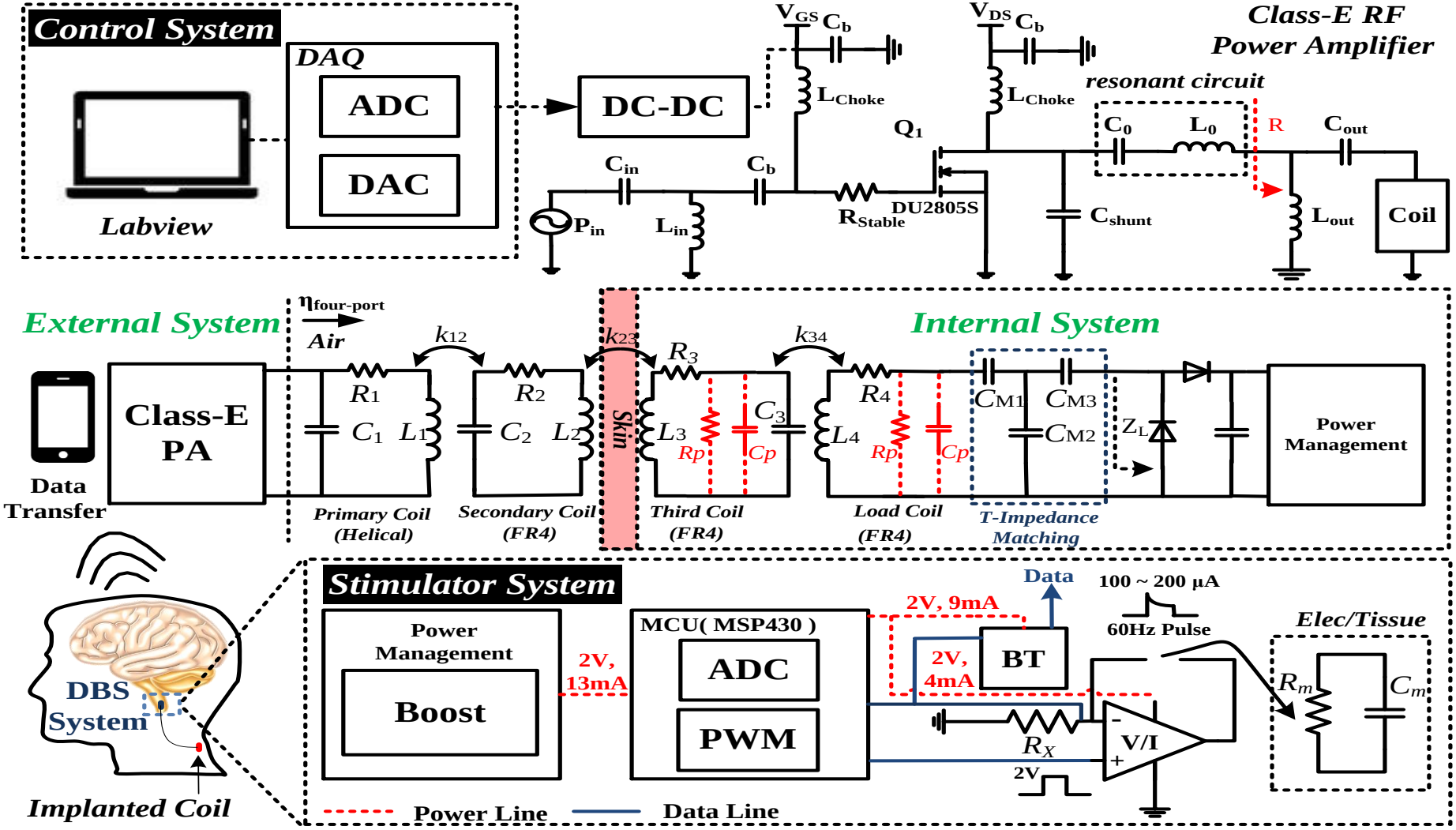
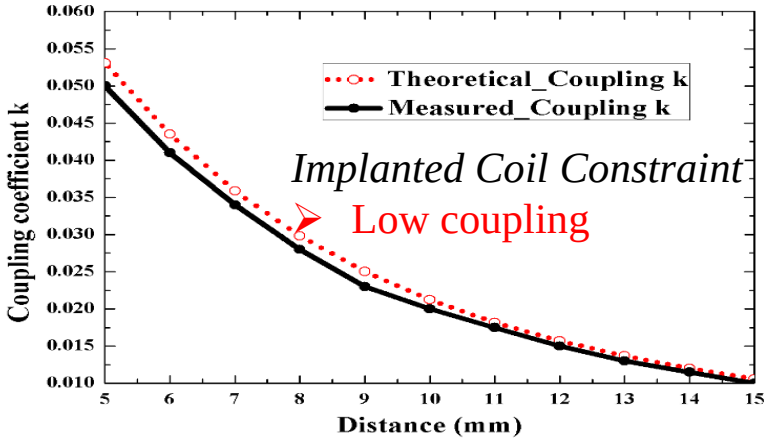
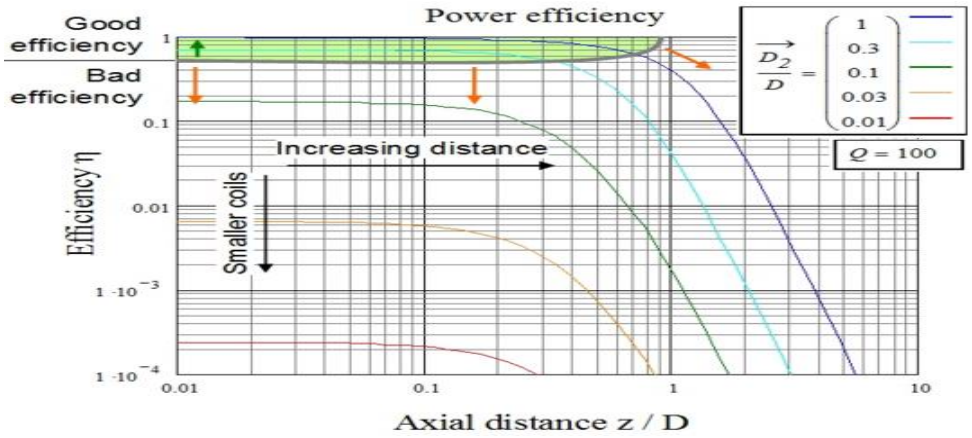
Overall Architecture Detection and Treatment System



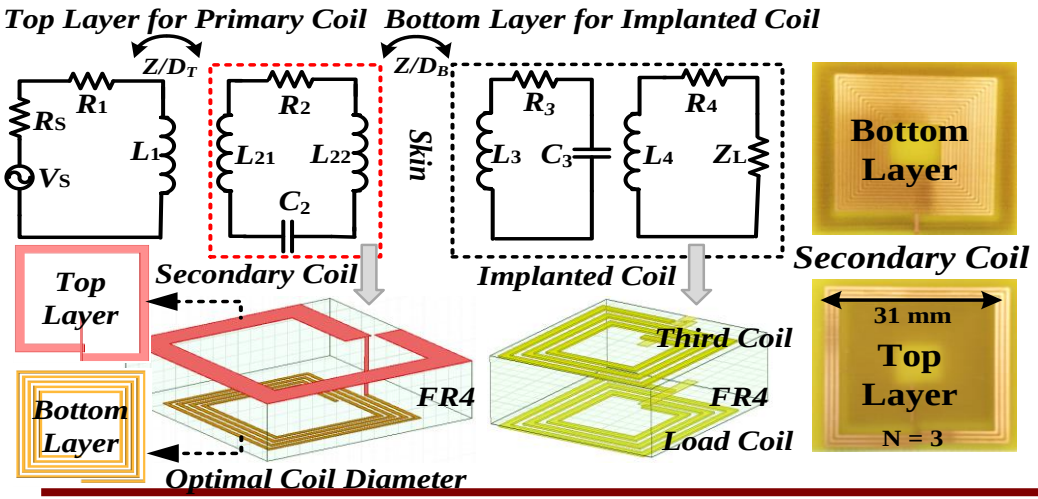
Problem Statement & Proposed Methods

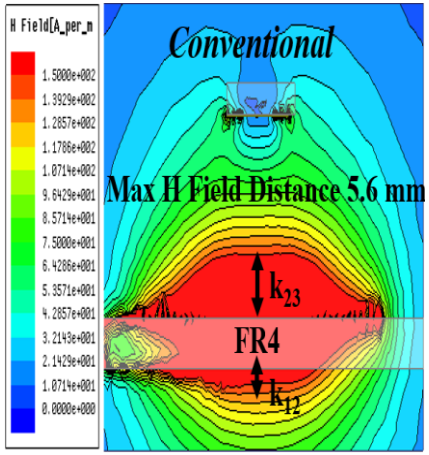


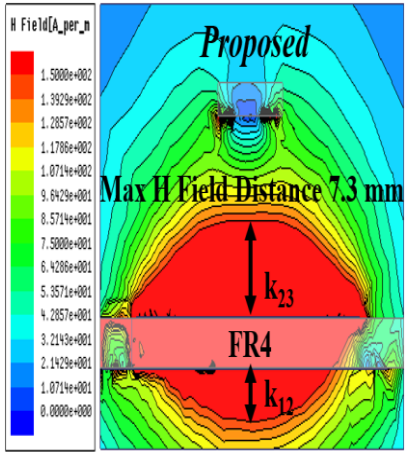


Embedded coils have strict restrictions on the size.

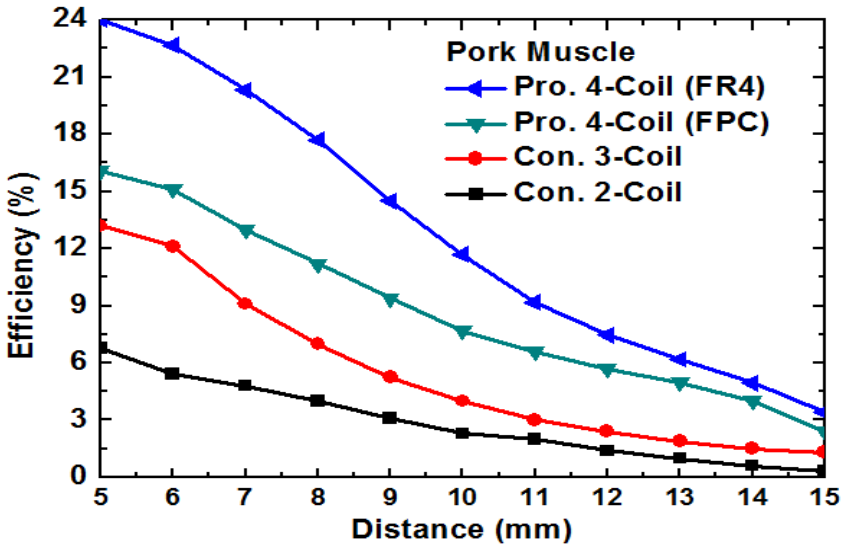
How can we design optimal transmission distance and the related coil diameters?

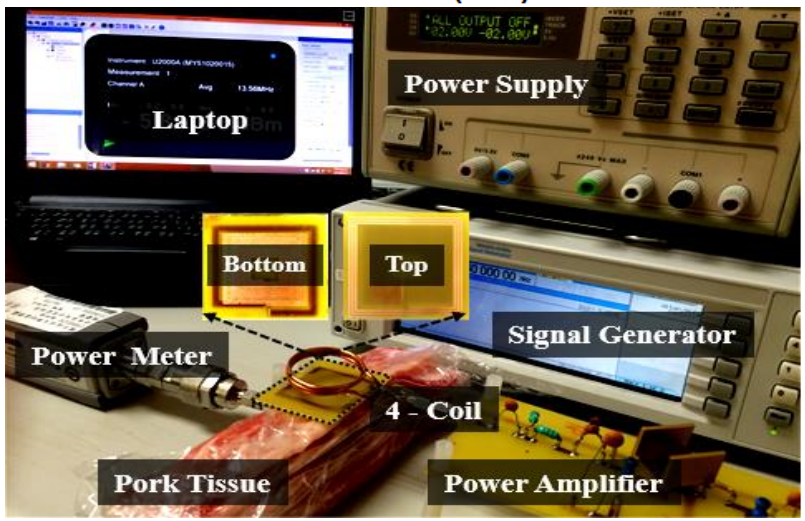


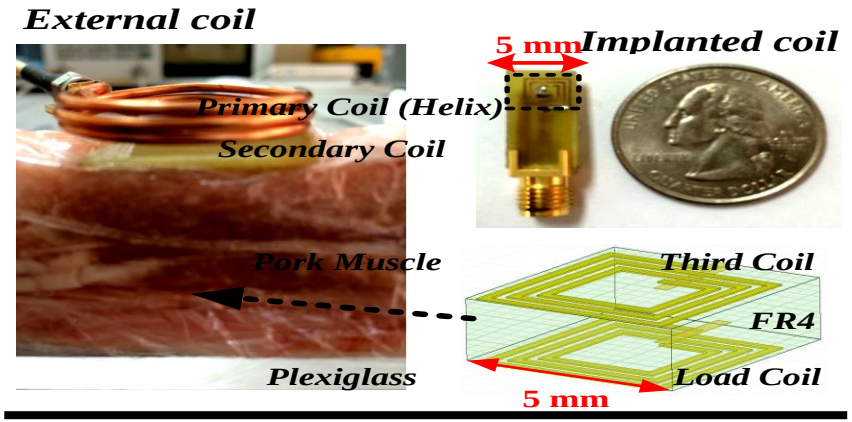


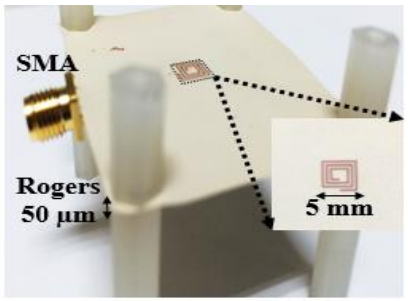


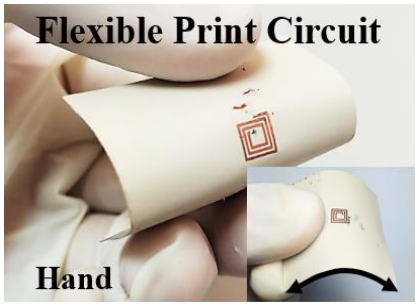
Experimental Results and Discussion

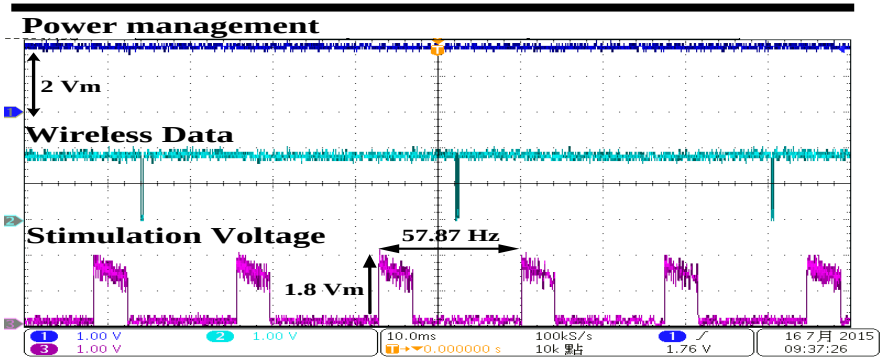












Comparison of Implantable WPT Systems

$$FOM = \frac{\eta(\%) \times S^3}{A_{RX}^{3/2}}$$

	Tech.	Freq. (MHz)	Media	η (%)	S (mm)	A (mm^2)	FOM
This Work	PCB	13.56	Air	19.1	10	25	153
This Work	PCB	13.56	Muscle	11.7	10	25	94
[1]	PCB	13.56	Air	75	10	250	19
[1]	PCB	13.56	Muscle	58.2	10	250	15
[2]	PCB	535	Air	0.04	13	1	88
[3]	PCB	915	Muscle	0.08	15	4	39
[4]	CMOS	187	Air	1.42	10	4.3	160
[4]	CMOS	160	Muscle	0.8	10	4.3	90

[1]R.F. Xue, K.W. Cheng, M. Je, "High-Efficiency Wireless Power Transfer for Biomedical Implants by Optimal Resonant Load Transformation," *IEEE Trans. Biomedical Circuits and Systems*, Apr. 2013.

[2]M. Mark, Y. Chen, C. Sutardja, C. Tang, S.; Gowda, M. Wagner, D. Werthimer, and J. Rabaey, "A 1mm² 2 Mbps 330 fJ/b transponder for implanted neural sensors," in *Proc. Symp. VLSI Circuits*, Jun. 2011

[3]S. O. Driscoll, A. Poon, T. Meng, "A mm-sized implantable power receiver with adaptative link compensation," in *Proc. IEEE Int. Solid- State Circuits Conf*., Feb. 2009

[4] M. Zargham, P.G Gulak, "Fully integrated on-chip coil in 0.13μm cmos for wireless power transfer through biological media," IEEE Trans. Biomedical Circuits and Systems, Apr. 2015.