ASA Fall 2023

https://acoustics23sydney.org
Abstract 3pBAb3, Dec. 6, 2023

View Abstract

CONTROL ID: 3968107

TITLE: Delivering Wireless Ultrasound Energy to Remote Systems: Design Implications for Powering Medical Implants Requiring Milliwatt versus Several Watts of Power

AUTHORS (FIRST NAME, LAST NAME): Inder Raj S. Makin[1], Paul Jaeger[2], Harry Jabs[2], Thomas P. Ryan[2], Douglas Mast[3], Leon J. Radziemski[2]

INSTITUTIONS (ALL): 1. School of Osteopathic Medicine, A.T. Still University of Health Sciences, Mesa, AZ, United States.
2. Piezo Energy Technologies, LLC, Mesa, AZ, United States.
3. Biomedical Engineering, University of Cincinnati, Cincinnati, OH, United States.

ABSTRACT BODY:

Abstract (200 words): Current medical device technological advances either involve, miniaturization or wireless operation or both. Miniaturization enables implant placement closer to target organs, e.g., blood vessels, viscera, or neurological structures, while wireless powering of larger left-ventricular assist devices (LVAD) is desired to mitigate infection risk due to wires. Ultrasound is a viable energy modality, wirelessly propagating through material media (tissue) and either directly powers systems, or charges an integrated battery. Whether powering implantables, or non-implantable systems, such as digital devices, ultrasound power transfer approaches have to be application-specific. This talk will present data and development strategies for four distinct use-cases requiring respectively, <5 mW (miniaturized systems), ~500 mW (implantable pulse generators, IPG), ~2 W (non-implanted digital systems), and ~8 W (LVADs). Choice of low-MHz frequency, planar single-element or coarse array transmit sources, as well as application-dependent receivers a few wavelengths in size (low-mW), to 45 mm diameter (~8 W), will be described. Benchtop experiments demonstrate successful ultrasound charging of a miniaturized solid-state (250 mAh) battery within 20 minutes. Results from live porcine model studies show a 200 mAh Li-ion battery within a Ti-shelled IPG, being successfully charged without thermal-effect-related tissue changes in the propagation path. [Work partially supported by NIH/NIBIB R43EB019225]

CURRENT TECHNICAL COMMITTEE: BIOMEDICAL ACOUSTICS

CURRENT SPECIAL SESSION: Bridging Preclinical and Clinical Acoustics

PRESENTATION TYPE: Contributed Submission : Lecture

PRESENTER: Inder Raj Singh Makin

AWARDS:

PACS Numbers: 43.80.Vj

Additional Comments: Due to the uniqueness of the topic of our research, we would request the Abstract be placed in the Bridging Preclinical and Clinical Acoustics session

Author Disclosure 1: Yes

Author Disclosures 2: Yes

Author Disclosure 3: Neither of the above

Ethical Principles: I have complied with the ASA Ethical Principles.