



Load Adaptive, Reconfigurable Active Rectifier for Multiple Input Multiple Output (MIMO) Implant Power Management

Tech ID: 28916 / UC Case 2017-510-0

SUMMARY

UCLA researchers in the Department of Electrical Engineering have invented a novel full-fledged implant power management unit, which is highly programmable and can process multiple input power deliveries on-chip.

BACKGROUND

For fully implantable biomedical devices, active realization of the active rectifier for wireless power transfer (AR-WPT) requires high power efficiency and load adaptive ability. During the implant functioning, the electrical load requirement changes in time from very light to very high. Most previous designs ignore the need for real-time load adaptation and excessive power is dumped to the DC-limiter. Other techniques partially solve the problem by fixing either the ON or OFF delay or introducing a fixed offset at the path, while others require off-chip offset calibration. To truly solve this problem, both the real-time offset calibration for reconfigurable AR-WPT and the implemented adaptive load control (ALC) unit, which prevents unnecessary power delivery to the output, need to be dealt with concurrently.

INNOVATION

Researchers led by Professor Dejan Markovic have developed a novel reconfigurable, PVT invariant and power efficient AR-WPT that includes an ALC unit. With this ALC unit, the input power is controlled and excessive power at the output is significantly mitigated. As well, the efficiency of the rectifier is improved due to the new real-time offset controlled schemes, which are implemented for both types of diodes. This system is able to perform 5x-10x longer (battery time) compared to the state-of-the-art, has improved efficiency for a wide range of load currents, has reduced current leakage through the ALC unit, and does not require any off-chip calibration.

APPLICATIONS

- Fully implantable biomedical devices
- Implant power management units

ADVANTAGES

- Excessive power at output is mitigated
- Improved rectifier efficiency
- 5x-10x longer battery life
- Can be used with a wide range of load currents
- Reduced current leakage
- No off-chip calibration required

STATE OF DEVELOPMENT

Prototype devices have been developed and extensively tested.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,043,843	06/22/2021	2017-510

CONTACT

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INVENTORS

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OTHER INFORMATION

KEYWORDS

Implant, biomedical implant, implant power management unit, IPMU, multiple input multiple output, MIMO, PVT invariant, reconfigurable active rectifier, active rectifier for wireless power transfer, AR-WPT, load adaptive, adaptive load control, ALC, on chi

CATEGORIZED AS

- **Biotechnology**
 - Other
- **Engineering**
 - Engineering
 - Other
- **Medical**
 - Devices
 - Other
- **Sensors & Instrumentation**
 - Medical

RELATED CASES

2017-510-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ Scalable Parameterized VLSI Architecture for Compressive Sensing Sparse Approximation
- ▶ Autonomous Thermoelectric Energy-Harvesting Platform for Biomedical Sensors
- ▶ Electrode Agnostic, Supply Variant Stimulation Engine For Implantable Neural Stimulation
- ▶ A Simple, Area-Efficient Ripple-Rejection Technique for Chopped Bio-Signal Amplifiers
- ▶ Saturation-Tolerant Electrophysiological Recording Interface
- ▶ A High Dynamic-Range Sensing Front-End For Neural Signal Recording Systems
- ▶ A Distance-Immune Low-Power Inductively-Coupled Bidirectional Data Link

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