A FLEXIBLE MONOPOLAR STIMULATOR FOR ANIMAL STUDIES IN AUDITORY PROSTHESES

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1. Introduction

- This paper presents the design of a bench-top monopolar stimulator (BT-MoSTM) that can be used for animal studies in cochlear implants.
- The stimulator is controlled by three high-speed digital Input/Output (I/O) cards manufactured by National Instruments Corporation and is electrically isolated.
- The stimulator provides sixteen independently controlled charge-balanced monopolar channels, each varying in stimulation parameters.
- Four stimulation patterns, which are symmetric biphasic, non-symmetric biphasic, triphasic and amplitude modulate biphasic, are available in either simultaneous or interleaved modes.
- A user-friendly and intuitive MATLAB Graphical User Interface (GUI) is provided with the stimulator board to simplify its control and use.

2. System Overview

MATLAB GUI

PCI-6534

BT-MoSTM

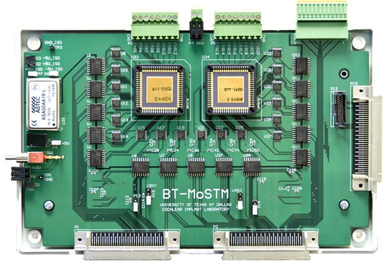

Fig.1. BT-MoSTM stimulation platform control stack

3. MATLAB GUI

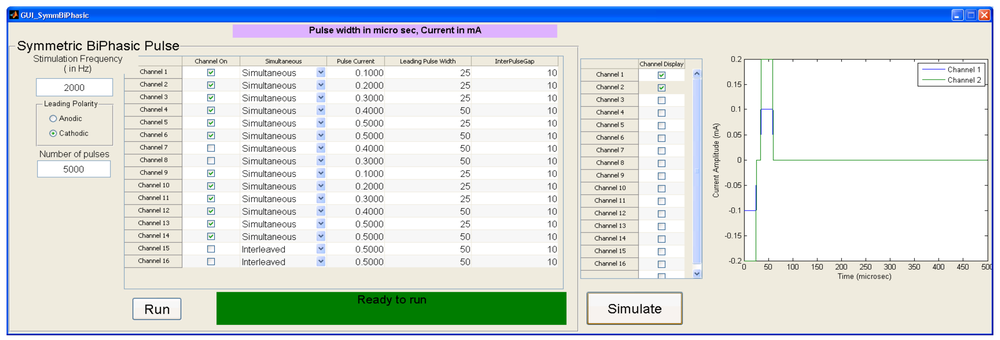

Fig. 2. MATLAB GUI screen shot of Symmetric Biphasic stimulation

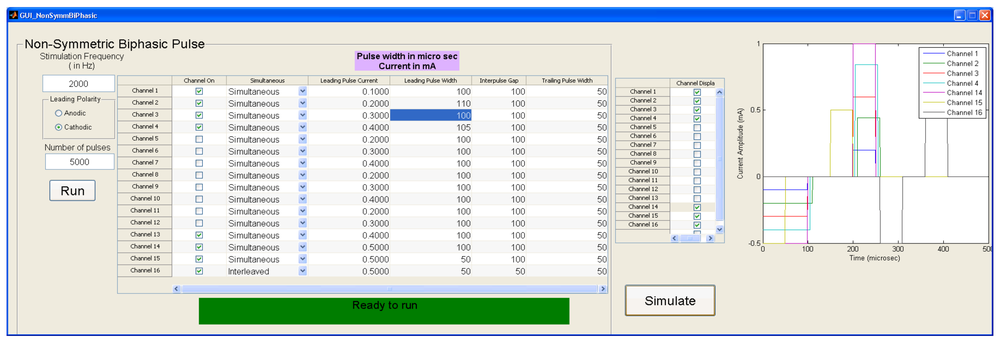

Fig. 3. MATLAB GUI screen shot of Non-Symmetric Biphasic stimulation

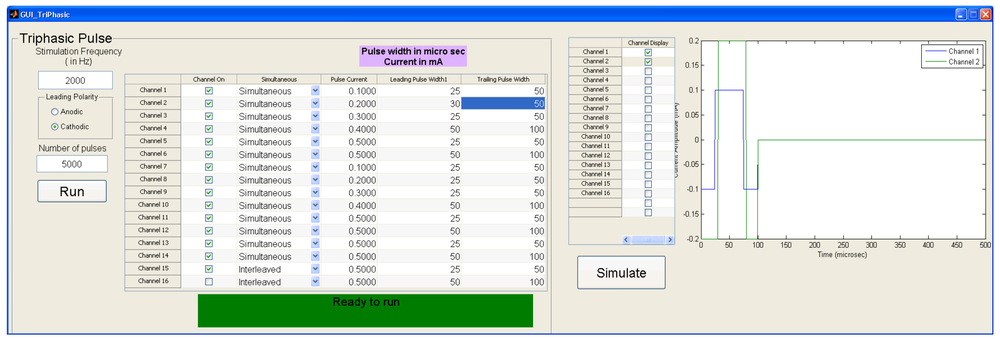

Fig. 4. MATLAB GUI screen shot of Triphasic stimulation

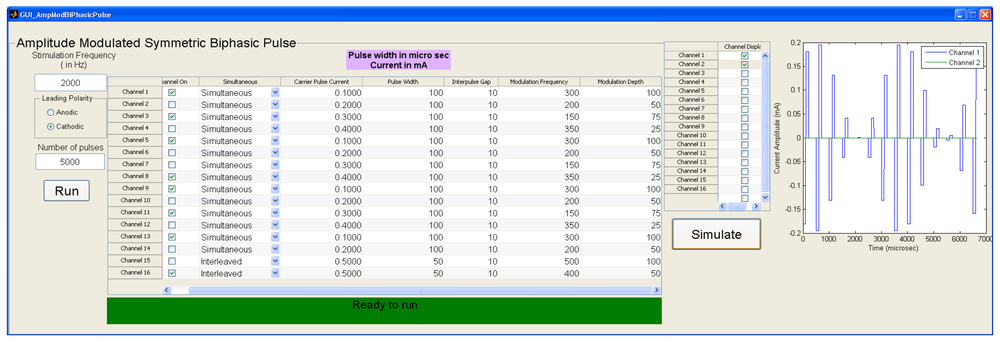

Fig. 5. MATLAB GUI screen shot of Amplitude Modulated Biphasic stimulation

4. BT-MoSTM

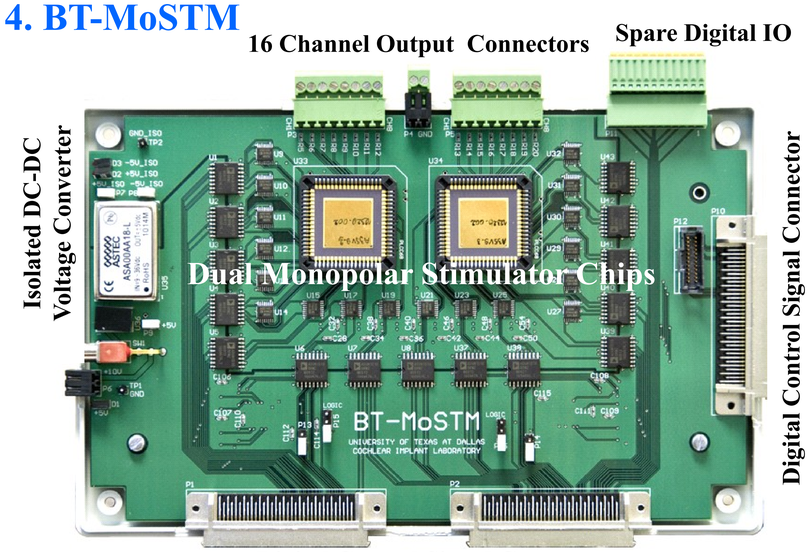

Fig.6. BT-MoSTM board

- 16 independently controlled and charge-balanced monopolar channels
- 5 V compliance voltage
- 1 mA maximum current amplitude per channel
- 7-bit current amplitude resolution per channel
- 4 us minimum pulse width per channel
- 0 us minimum interphase gap per channel
- 4 us minimum interstimulus interval per channel
- 83.3 kHz maximum pulse rate per channel
- >50 MHz output resistance per channel

5. Conclusions

- Presented in this paper is the design of a flexible monopolar current stimulation system for chronic cochlear implant studies on animals. The system is equipped with 16 independently controlled and charge-balanced monopolar current outputs that can easily be programmed to generate a wide array of stimulation waveforms.
- A user-friendly MATLAB GUI has been created to simplify the task of controlling the BT-MoSTM board by allowing the user to simply specify a set of desired stimulation parameters including pulse width, interphase gap, pulse rate, stimulation patterns, etc.

References

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- S. Guo, H. Lee. Biphasic-current-pulse self-calibration techniques for monopolar current stimulation. In: *Proceedings of the IEEE Biomedical Circuits and Systems Conference*, Beijing, China, 2009, 61 - 64.

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