



Functional Feedback Mechanisms for Image-Guided Tibial Neuromodulation

Steven Fairley^{1,2}, Steve J. A. Majerus^{2,3}

¹Cleveland State University, Department of Electrical Engineering

²Advanced Platform Technology Center, Louis Stokes Cleveland VA Medical Center

³Case Western Reserve University, Department of Electrical, Computer, and Systems Engineering

Circuit Simulations

- Ultrasonic element receives energy and produces a small current
- To simulate a nerve being stimulated, an interface circuit was designed to detect the small current and convert it into a digital pulse
- Circuit designed and simulated in LTSPICE

Background

- We will develop an advanced phantom for FUS research, which will copy relevant body parts like bones and blood vessels but will also react to FUS stimulation
- This phantom is essential to develop accurate algorithms incorporating functional feedback and adaptive image processing to track and stimulate nerve targets in real Center Wen for supporting this work. The contents do not represent the view of the US Government or the US Department of Veterans Affairs.

Conclusions

- Transimpedance amplifier and envelope detector are an effective interface for converting small ultrasound pulses into measurable voltage signals
- Interface will allow detection and timing of pulses by a controller
- Controller can generate movements in the ultrasound phantom to simulate a human nerve being stimulated with ultrasound

Next Steps

- Design printed circuit board for the interface circuit
- Using Eagle PCB Designer
- Circuit board will be fabricated and assembled for bench testing with the ultrasound phantom of the ankle

Figure 6: Output of comparator showing conversion of the short ultrasonic current pulse into a digital waveform. The output is inverted because of the polarity of the transimpedance amplifier, but detection of the pulse duration is possible.