TRANSPORTATION POOLED FUND PROGRAM
QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): ____IOWA DOT

INSTRUCTIONS:

Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.

Transportation Pooled Fund Program Project # *TPF-5(449)*	**Transportation Pooled Fund Program - Report Period:** Quarter 1 (January 1 – March 31, 2020) Quarter 2 (April 1 – June 30, 2020) X Quarter 3 (July 1 – September 30, 2020) Quarter 4 (October 1 – December 31, 2020)
Project Title: Robust wireless skin sensor networks for long-term fatigue crack monitoring of bridges	
Project Manager: **Phone:** **E-mail:** Khyle Clute 239-1471 khyle.Clute@iowadot.us	
Project Investigator: **Phone:** **E-mail:** Simon LaFlamme 294-3162 laflamme@iastate.edu	

Lead Agency Project ID:	**Other Project ID (i.e., contract #):** Addendum 736	**Project Start Date:** May 15, 2020
Original Project End Date: May 14, 2023	**Contract End Date:** May 14, 2023	**Number of Extensions:**

Project schedule status:

X On schedule ☐ On revised schedule ☐ Ahead of schedule ☐ Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Total Percentage of Work Completed
$ 540,000	$18,900	1%

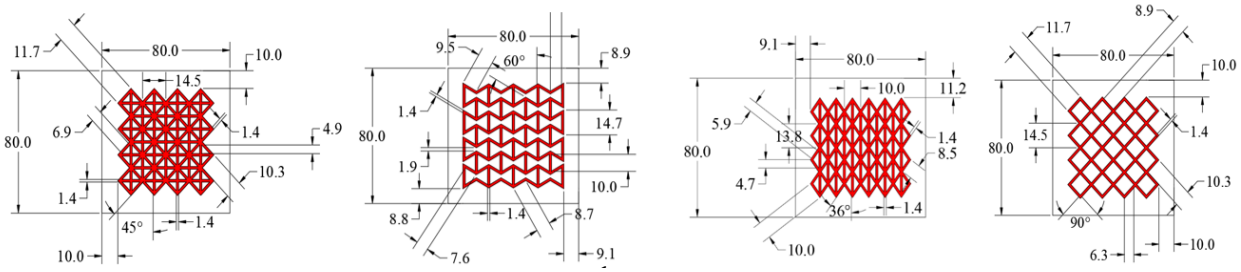
Quarterly Project Statistics:

Total Project Expenses This Quarter	Total Amount of Funds Expended This Quarter	Percentage of Work Completed This Quarter
$15,400		

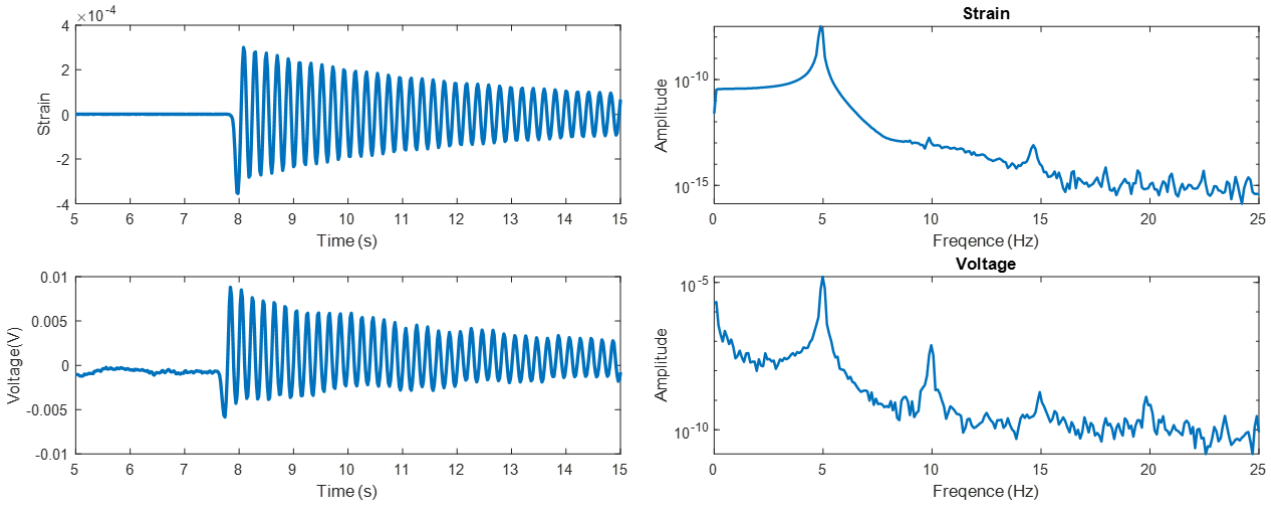
Project Description:

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

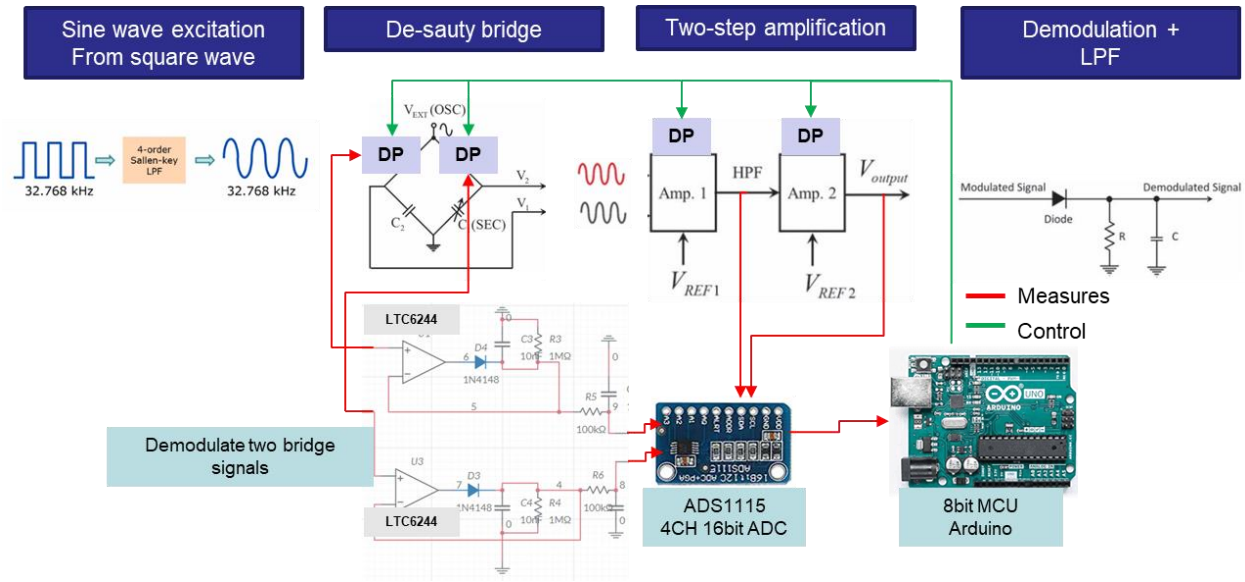
- TAC meeting on Oct 6th 2020.
- ISU fabricated non-textured SEC sensors and shipped to institutional partners.
- ISU fabricated textured SEC using four different corrugation patterns (shown below).



- ISU conducted preliminary tests on C(t) specimens to study the performance of the patterned sensor.
- KU calibrated the UA board (from the first generation sensor) for field deployment.
- KU validated the UA board connected to an SEC and compared against a commercial foil gauge. The figure below compares the signal of the foil gauge (top) versus SEC (bottom) showing a great agreement between both signals.



- UA investigated the pre-demodulation method for automated balancing of the De-sauty (i.e. AC Wheatstone) bridge circuit that converts dynamic capacitance change of the SEC into DAQ readable voltage signal. The figure below shows the onboard signal processing flow for the UA sensor board: local MCU and 16bit ADC control the De-sauty bridge balance and signal amplification using the pre-demodulated signal.
- UA tested and confirmed that the quality of the pre-demodulated signal is sufficient for the De-sauty bridge balance monitoring.



- USC validated the previously developed analytical model for the out-of-plane deformation of the SEC that relates a change in capacitance to a suspected out-of-plane deformation.
- USC developed and fabricated a concrete beam with controlled surface textures for testing of SEC using a variety of adhesion methods.
- USC started the development of an automated test fixture and procedure for the SEC on the concrete beams that will allow for the testing of automated and synchronized testing of SECs on concrete beams.

Anticipated work next quarter:

- ISU will finish tests on C(t) specimens.
- KU will refine UA board balancing and provide wireless capabilities.
- UA will assemble and test a prototype on the component level circuit.
- USC will continue development and test the concrete specimens with controlled surface textures.

Significant Results:

- Preliminary data on textured SECs on C(t) specimens.
- Prepared Gen1 readout board for field deployment.
- Gen2 readout board first prototype fabricated.
- Tests on complex geometries prepared.

Circumstance affecting project or budget (Describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope, and fiscal constraints set forth in the agreement, along with recommended solutions to those problems). N/A