

Ultrasonic-Assisted Micro-Wire Bonding & Embedding towards 3D Printed Soft Electronics

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Abstract (in 12 Pt Arial Font)

The goal of this study is to develop a novel ultrasonic wire bonder and integrate it as a tool for robotic assembly. In the 1st stage of development, we combined an ultrasonic transducer with a 3D Gantry platform to manually execute wire bonding with our ultrasonic tool. We studied the effect of process parameters such as wire material and dimension, ultrasonic power and its duration, and mechanical compression. We also developed a novel technique to cut wires at desired point with no hand intervention. In the 2nd stage of development, we integrated the previously-developed ultrasonic unit with the 6DOF robotic arm. This further expanded our unit capability to perform wire bonding in an automated fashion and with increased precision. Examples workpieces include wire bonding (40 μm Gold wire) on microrobot with small feature size of 200 μm or below and creating multiple wire pattern on Al plates.

Biography of Presenter (in 12 Pt Ariel Font)

Alireza Tofangchi earned his Ph.D. degree in Mechanical Engineering from University of Illinois at Urbana-Champaign (UIUC) in 2015. Served as a Visiting Assistant Professor at St. Ambrose University in the following year, he later joined Prof. Saif lab in 2016 as postdoctoral research fellow and focused on designing various types of force/stiffness sensors featuring several orders of magnitude in measurement range, applicable



for studies of soft tissue/materials in-vivo. In 2017, he joined Dr. Keng Hsu's Advanced Manufacturing Lab at the University of Louisville as a senior research associate. Since then, he has been involved in several projects mainly focused on process development of hybrid, Ultrasound- FFF 3D printed techniques to fabricate smart, tunable soft sensor/actuators with various applications. He has also been involved in Next Generation Research Group-MRI in Dr. Popa's group since 2018, to contribute in design and integration of FDM-Ultrasonic electrode patterning/DAED system with the new platform of Robotic assembly in Nexus system. Dr. Tofangchi is recipient of the Othmer Fellowship award, holds filed several patents and published several peer-reviewed journal articles.