# Liquid Metal Interconnects for Conformable Sensor Packaging Enabling Inertial Measurements of Animals and Soft Robots

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## Abstract

In biomechanics, inertial measurements units (IMUs) are used to map the dynamic modes and gates of locomotion of animals. Typically, thin wires are soldered to the IMU and the package is bonded to the location of interest, on the animal, using cyanoacrylate or epoxy. These types of adhesives and the solder of the interconnects are brittle and typically fail from cyclic loading of the animal flexing its body. The same situation can be found in soft robotics, where a compliant and durable way of connecting electrical components within the body of the robot is required to maintain its "soft" characteristics. To solve this problem, we propose a self-contained package, which encapsulates an IMU, made from a flexible elastomer with room temperature eutectic metal interconnect "wiring." Because of the compliant nature of the materials used, the electronics package can then be bonded to a flexible surface with van der Waals forces. Using eutectic metal allows for compliant interconnects that will not break or change their resistivity under large strains. The electrical connections between the solder pads of a 3x3x1mm IMU are bridged to the required capacitors in 100x50µm microfluidic channels. 88µm diameter wires that exit the package to measurement electronics are attached by submersion of their stripped conductor in 300µm diameter wells. A positive pattern for molding the microfluidic system was manufactured by standard SU-8 photolithography on a Si chip where the IMU, capacitors and wires were placed on specific features of the micro-channels and encapsulated and filled with liquid metal.