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Design and Construction of a Low-Cost Mechanical Scanning System and Control Interface for Scanning Acoustic and Photoacoustic Microscopy[1] JOHN T. BONHOMME, CORNELIU I. RABLAU, TIMOTHY A. STILES, RONALD E. KUMON, Kettering University — We have designed and started construction of an instrument that will be able to serve as both a scanning acoustic microscope (SAM) and photoacoustic microscope (PAM). This instrument will be capable of imaging the volume of optically opaque specimens that are approximately 2 cm x 2 cm in lateral dimensions with both acoustic and optical contrast. When operating as a SAM, the specimen will be water-coupled to a high-frequency ultrasound transducer operating in pulse-echo mode. When operating as a PAM, short light pulses (˜100 ns, 5 to 10 μJ/pulse) from a 905 nm infrared laser diode located under the specimen will generate ultrasound pulses thermoelastically, which will then be received by a confocal high-frequency transducer. In both cases, the specimen will be raster-scanned under the transducer by a moving stage. The mechanical scanning system was designed and built using a spring-loaded microscope stage, micrometers, stepper motors, a shield board used for 3D printers, an Arduino Mega microcontroller, and a Raspberry Pi 4 microcomputer. A graphical user interface was written in Python using Tkinter to send the motion control commands to the stage. Future work will include incorporation of the laser and transducer control systems.

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