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Fluid Mechanics Experiments as a Unifying Theme in the Physics Instrumentation Laboratory Course DANIEL BORRERO-ECHEVERRY, Department of Physics, Willamette University, Salem, OR 97301 — We discuss the transformation of a junior-level instrumentation laboratory course from a sequence of cookbook lab exercises to a semester-long, project-based course. In the original course, students conducted a series of activities covering the usual electronics topics (amplifiers, filters, oscillators, logic gates, etc.) and learned basic LabVIEW programming for data acquisition and analysis. Students complained that these topics seemed disconnected and not immediately applicable to "real" laboratory work. To provide a unifying theme, we restructured the course around the design, construction, instrumentation of a low-cost Taylor-Couette cell where fluid is sheared between rotating coaxial cylinders. The electronics labs were reworked to guide students from fundamental electronics through the design and construction of a stepper motor driver, which was used to actuate the cylinders. Some of the legacy labs were replaced with a module on computer-aided design (CAD) in which students designed parts for the apparatus, which they then built in the departmental machine shop. Signal processing topics like spectral analysis were introduced in the context of time-series analysis of video data acquired from flow visualization. The course culminated with a capstone project in which students conducted experiments of their own design on a variety of topics in rheology and nonlinear dynamics.

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