

552a A Suite of Web-Accessible Experiments for Teaching Heat Transfer

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We have developed a series of remotely controlled heat transfer experiments as part of the I-Lab project at MIT. The experiments are based on two hardware platforms custom designed and fabricated for us by Armfield Ltd., England. On the HT-30XC, a heat exchanger is mounted (flat plate, shell and tube, or double pipe). Cold water flows through the exchanger in a single pass, whereas hot water is recycled to a heated reservoir. Both fluid flow rates, their direction (cocurrent or countercurrent), and the inlet hot temperature are monitored and are under the students' control. All other inlet and outlet temperatures are monitored. Monitoring, control, and display of a graphical user interface is performed with a computer/web server using LabVIEW 7.1 software. The second platform, HT-10XC, has provision for three conduction experiments (transient and steady state linear conduction, radial conduction, and extended surface) and two radiation/convection experiments (interplay of radiation and convection, errors in thermocouples measurements). The conduction experiments, although simple in design, display unexpected transient behavior that does not follow standard textbook models and provide interesting pedagogical opportunities for assessing reasons for the observations. The experiments have been used successfully in various ways in courses. Student response has been generally favorable, and students appreciate the ability to take data from real equipment, especially in engineering science lecture courses that otherwise contain no laboratory component.