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Improving Students' Understanding of Lock-In Amplifiers¹ SETH DEVORE, ALEXANDRE GAUTHIER, JEREMY LEVY, SINGH CHANDRALEKHA, University of Pittsburgh — A lock-in amplifier is a versatile instrument frequently used in physics research. However, many students struggle with the basic operating principles of a lock-in amplifier which can lead to a variety of difficulties. To improve students' understanding, we have been developing and evaluating a research-based tutorial which makes use of a computer simulation of a lock-in amplifier. The tutorial is based on a field-tested approach in which students realize their difficulties after predicting the outcome of simulated experiments involving a lock-in amplifier and check their predictions using the simulated lock-in amplifier. Then, the tutorial guides and helps students develop a coherent understanding of the basics of a lock-in amplifier. The tutorial development involved interviews with physics faculty members and graduate students and iteration of many versions of the tutorial with professors and graduate students. The student difficulties and the development and assessment of the research-based tutorial are discussed.

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