香港城市大學
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Interactive Learning and Hands-on Electromagnetic Principles and Rules for Energy Engineering Students

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Abstract:

Electricity, magnetism, and electromagnetism play a key role in modern industrial development. However, a comprehensive understanding of electromagnetism is complex only with theoretical study for our energy engineering students. In particular, it is difficult for undergraduate (UG) students to understand well the abstract concepts and objects which they cannot see and touch.

Hence, this proposal aims to provide a new interactive learning strategy and hands-on projects for undergraduate students to strengthen their electromagnetism knowledge. On the one hand, the proposal will create an onsite mini-lab interactive learning way with well-design discovery-based interactive modules for UG students in classes. The discovery-based mini-lab modules mainly focus on the electric circuit discovery-based tests for the electric field study, electromagnet discovery-based tests for the magnetic field study, and electromagnetic induction discovery-based for the combination of electric field and magnetic field study. The key is to provide these three modules in class for UG students to have interactive learning experiences and hands-on practice. On the other hand, the proposal provides opportunities for UG students to further study advanced electromagnetic technologies by hands-on building wireless charging pads. With the provided inverter circuits, students can design the compensation circuits and transmitter pads. Under the QI standard, the wireless charging pad can charge mobile phones, smart watches, smart bracelets, smart earphones, etc. The hands-on designed wireless chargers can realize the function of commercial wireless chargers, which will motivate students to study the electromagnetism deeply.

Academic Publication:

Huang, Y., Liu, C., Xiao, Y., & Liu, S. (2020). Separate power allocation and control method based on multiple power channels for wireless power transfer. IEEE Transactions on Power Electronics, 35(9), 9046–9056. https://doi.org/10.1109/TPEL.2020.2973465

Xiao, Y., & Liu, C. (2020). A study of rotational movement and charging torque of reconfigured on-board charger. IEEE Transactions on Power Electronics, 35(10), 10720–10728. https://doi.org/10.1109/TPEL.2020.2979349

Xiao, Y., Liu, C., Huang, Y., & Liu, S. (2020). Concurrent wireless power transfer to multiple receivers with additional resonant frequencies and reduced power switches. IEEE Transactions on Industrial Electronics, 67(11), 9292–9301. https://doi.org/10.1109/TIE.2019.2952787

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Xiao, Y., Liu, C., Huang, Y., & Zhou, Y. (2019). A novel wireless power transfer system with two transmitting coils for three resonant frequencies and four receivers. 2019 22nd International Conference on Electrical Machines and Systems (ICEMS), 1–4. https://doi.org/10.1109/ICEMS.2019.8921596