Week 10

Challenges

ECE 410/510
Spring 2025

Instructions

- The challenges below are for you to delve deeper into the subject matter and to test your own knowledge.
- I'd suggest you try to solve at least one problem per week. More is obviously better.
- Practice "vibe coding" if necessary.
- Post your solution(s) in the `#weekly-challenges` Slack channel so everybody can appreciate what you did, ask questions, and make comments.
- Document everything for your portfolio and make your code available on Github.

Challenge #28: Model and simulate a memristor

Memristors are very important circuit elements of emerging neuromorphic hardware because they can directly emulate a synapse. Their resistive value represents the synaptic weight, while the weight can be changed by, for example, using a *Spike Timing-Dependent Plasticity* (STDP) rule (see lecture slide for details).

Learning goals:

- Learn how to model and simulate a memristor, either in Python or in SPICE

Tasks:

1. Download or write your own memristor model in SPICE or Python. E.g., you can use the Biolek model: https://www.radioeng.cz/fulltexts/2009/09_02_210_214.pdf
2. Visualize the characteristic pinched hysteresis loop in the I-V curve.
3. Document your results.