ECE209AS (Fall 2025)
Computational Robotics

Prof. Ankur Mehta ⟨mehtank@ucla.edu⟩

Problem set 1 | Systems and state

Due Tue, Sep 30, 2025 @ 9am PT

Key takeaways

After this lecture, you should understand:

- What kind of mathematical objects are used to formalize systems,

- The differences in formalisms between continuous and discrete space systems, and

- How to resolve any physical systems down to its canonical mathematical formulation.

Assignment

Formulate two stateful physical systems from the real world, one of which is continuous space and the other discrete space. Choose systems with state spaces **unrelated to motion and position**, and in particular choose systems distinct from those discussed in class. For each:

1(a). Describe the system in one or two sentences, clearly explaining in English what the specific input-output system is that you are considering.

1(b). Formalize the inputs, state, and outputs (and associated spaces) of this systems as explicit mathematical objects. This should be written out using formal rigorous mathematical notation.

1(c). Justify the Markov property as it applies to your selection of state representation for this specific system using one or two English sentences.

1(d). Describe in a short paragraph how you would go about mathematically formulating the respective equations f, h or probabilities P, O for this specific system. You don't need to write out the mathematical objects directly, but rather, explain how to transform your understanding of how this system behaves in the real world into into precise formalism we will use.

1(e). Would you be willing to let us use your correct responses as (anonymized) examples for the class?