

Characterizing System Performance

The Big Ideas:

- Poles characterize the change in a system over time.
- In response to a unit sample, the pole represents the multiplicative factor applied at each time step.
- Basic properties of the (dominant) pole in a system determine the system's long-term behavior.

Introduction

Last week, we focused on Linear Time Invariant Systems. We want to determine a system is LTI because it allows us to use things we know about LTI systems to analyze and predict the behavior of the system.

This week, we'll learn about poles: what they are, how to find them, and what they tell us about the long-term behavior of a LTI system. We'll also review the major application of the unit; the knowledge representations we've covered model systems in many different domains. In 6.01, we'll focus on control systems.

Vocabulary

In order to engage the material, be able to communicate about the topic with others, and in particular ask questions, we encourage familiarity with the following terms:
(at this point, you've probably noticed that terms get re-listed over multiple weeks. Think about how those terms relate to this week's material).

Theory

- Linear Time Invariant System
- System Function
- Geometric Sequence
- Pole
- Convergence/Divergence
- Feedback
- Complex Poles
- Dominant Pole

Practice

- `module sf`
- `poles`
- `poleMagnitude`
- `dominantPole`
- `Cascade`
- `FeedbackSubtract`

Check Yourself

After this week in 6.01, you should be familiar with the following:

Theory: you should understand:

- What a pole is and how to find one from a system function
- What a pole tells you about a system's long-term behavior
- What it means for a system to have multiple or complex poles

Practice: you should be able to:

- Build a simple controller, model it using knowledge representations from the module, and discover its long-term behavior based on poles
- Model smaller systems using difference equations/block diagrams
- Complete problems from Midterm 1 from previous years in a timely manner.

Resources

Theory: Section 5.5 of the 6.01 Course Notes is relevant to this week. All of Chapter 5 is relevant to this unit.

Practice: The 6.01 Software Documentation will come in handy, in particular modules `sf` and `sm`. You may want to take a look at `ltism`.

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6.01SC Introduction to Electrical Engineering and Computer Science
Spring 2011

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