Chapter 8: Discretization of Continuous-time Systems

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Outline

Discretization

Use of discretization

Many systems in the real world are continuous-time systems: chemical reactions, rocket trajectories, power plants, ice cap melting... Computers, however, are mainly digital. If we want to **simulate** the continuous system with a digital device, we need a method to convert the continuous model into a discrete one. This conversion is called "discretization". Discretization also comes in handy when a continuous **filter with useful properties** has been designed and a discrete filter with the same properties is required. In addition, discretization is also used in **control**. For instance, in order to design a digital controller it is necessary to have a discrete model of the plant, which is typically given in the form of differential equations.

Discretization

Problem statement

While converting, some information of the continuous model may be lost due to the different nature of the systems. It is important that the loss of information is minimized. Each discretization method has its own qualities and they will all lead to different discrete representations of the same continuous system.

Discretization methods discussed in this chapter

- Numerical Integration
- Impulse Invariant Method
- Zero-pole Equivalent
- Hold Equivalents