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Industrial Control Systems: From Control Point of View

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Lecture 20

- Working down in scale...
 - » Supervisory control

 - » Digital Implementation

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- Analog control

- The actual process

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Control Example: Cruise Control

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- What is the Process Variable?
- What are the inputs?
- Forces?

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Feedback diagram

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Control Loop

- Proportional Control
 - » V (control output) = $K_p * e + m_0$
 - Nominal control position: m_0
 - Proportional gain: K_p
 - Error between: $e = vel_{desired} - vel_{actual}$
 - » Control output changes throttle
 - A human driver would push down on gas pedal

Response on steep hill?

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Change control system design

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PID Control diagram

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- Tuning challenges → widely used

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Implementation?

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- Mechanical designs:
- Analog electronics

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Digital Implementation

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- Move bit patterns around

- Why bits (and not analog signals)

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Numbers, money, pixels, etc....

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- Enormous (and growing) infrastructure to manage, process, transmit bits

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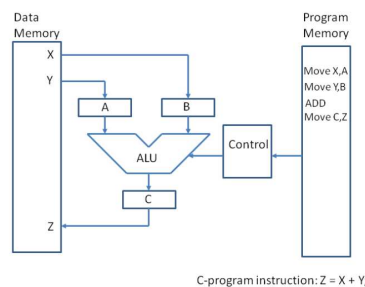
Processor Implementation:

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- Universal stored program computer

Sequential Stored Program Computer Architecture



/on Neumann and Harvard models

Fetch and execute instructions sequentially.

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U I	Many Other Control Options...	<i>CS&ECE 444/544</i>
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<ul style="list-style-type: none">• Local Control		
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Computing Applied for ICS at Different Levels

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- Communication infrastructure

- Supervisory Functions (at control centers)

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Limitations

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- Serial
- Managing complexity
- Real time computing

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Classifying Real Time

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