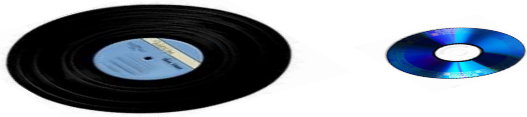


6.003: Signals and Systems

From LPs to CDs –
and how 6.003 helps get you there



December 8, 2011

Subject Evaluations

Your feedback is important to us!

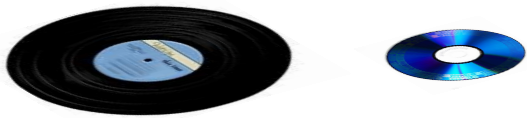
Please give feedback to the staff and future 6.003 students:
<http://web.mit.edu/subjectevaluation>

Evaluations are open until Friday, December 16, at noon.

You will be able to view quantitative results at
<http://web.mit.edu/subjectevaluation/results.html>
and student-written summaries at
http://hkn.mit.edu/ug_sel.php

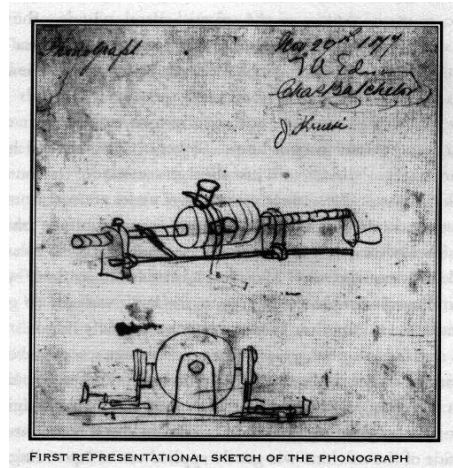
6.003: Signals and Systems

From LPs to CDs –
and how 6.003 helps get you there



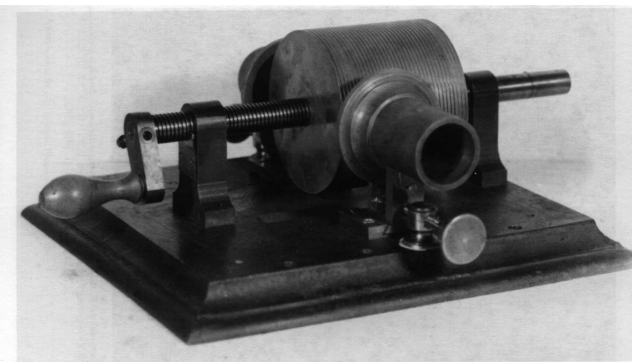
December 8, 2011

Edison's Phonograph



FIRST REPRESENTATIONAL SKETCH OF THE PHONOGRAPH

Edison's Phonograph



Edison's Phonograph



Edison's Phonograph



Edison's Phonograph



Edison's Phonograph



Edison's Phonograph



Edison's Phonograph



Edison's Phonograph

LPs: 100 years of optimization → good fidelity, but

- fragile: easily scratched
- lots of distortions: e.g., wow and flutter
- expensive

CDs: much higher fidelity

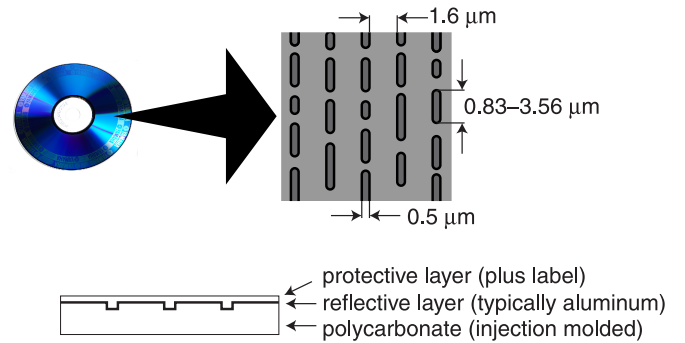
- nearly indestructible
- very low distortion
- inexpensive

→ many of these advantages made possible by concepts from Signals and Systems!

Edison's Phonograph



What's on a CD?



Edison's Phonograph

LPs: 100 years of optimization → good fidelity, but

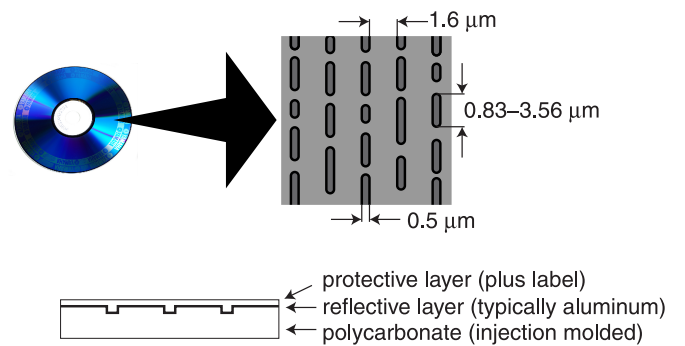
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What's on a CD?



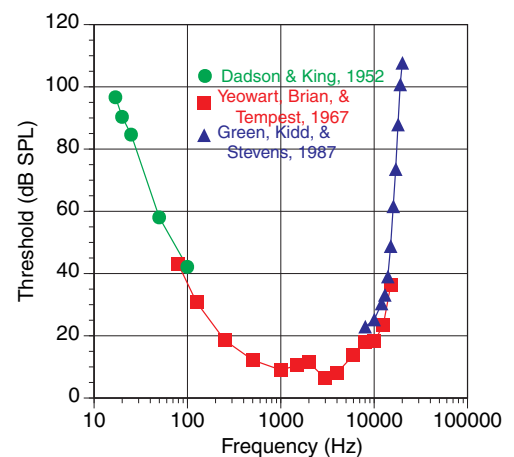
What's on a CD?

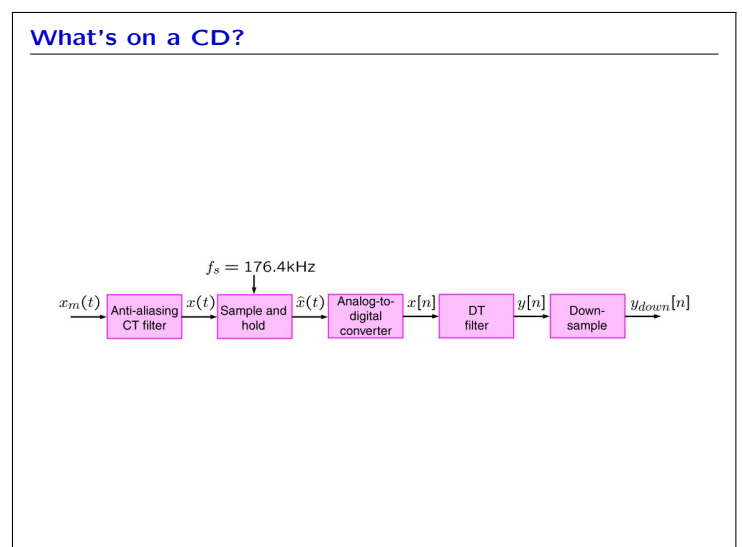
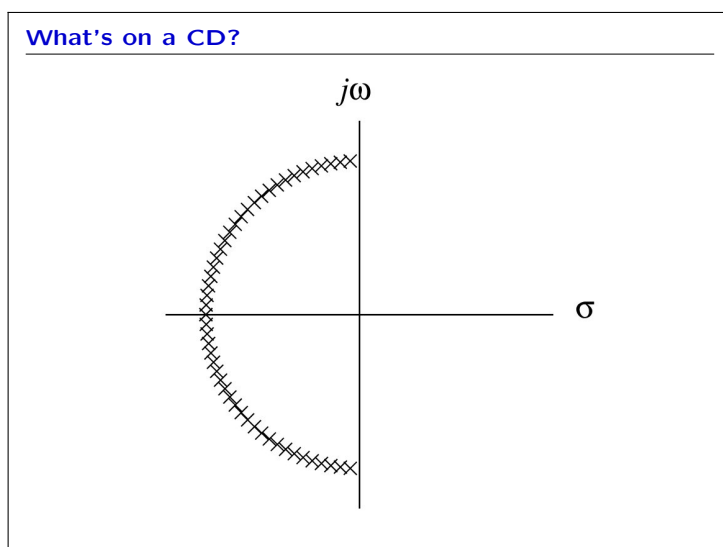
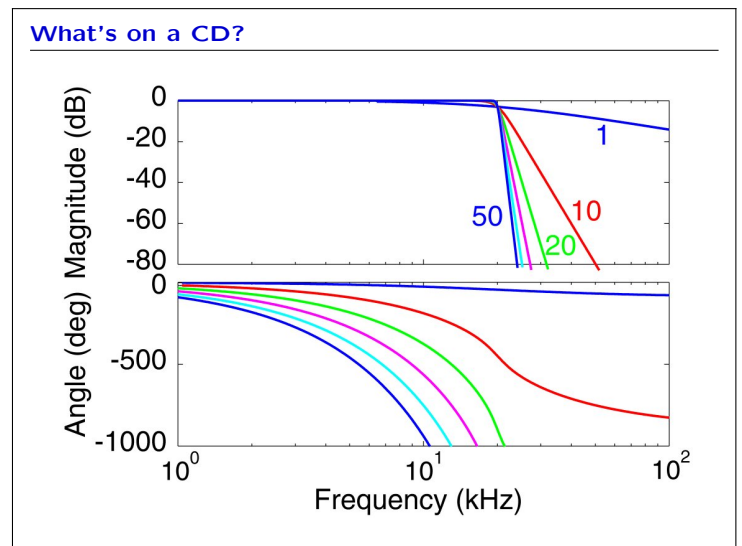
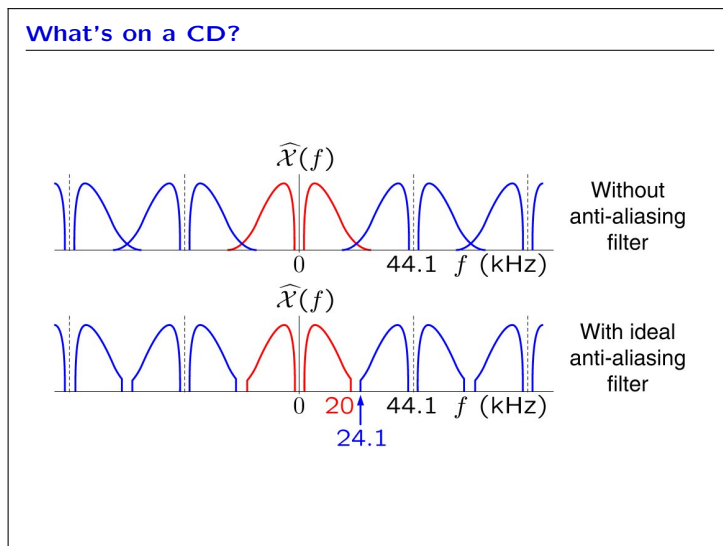
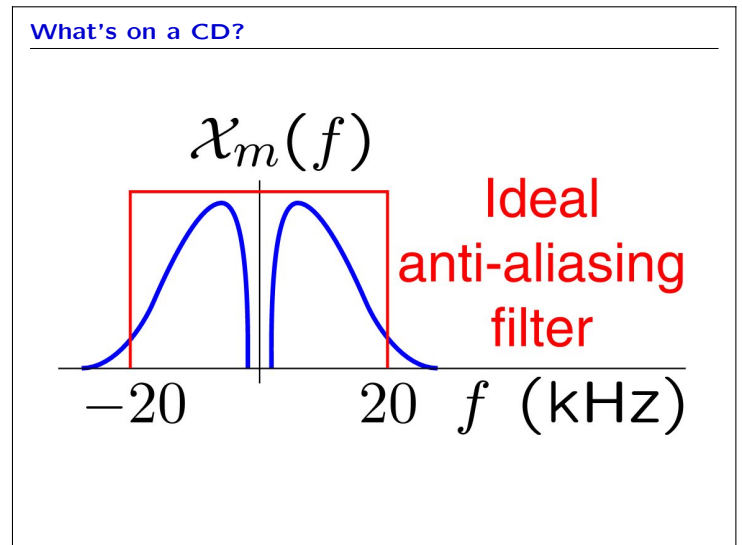
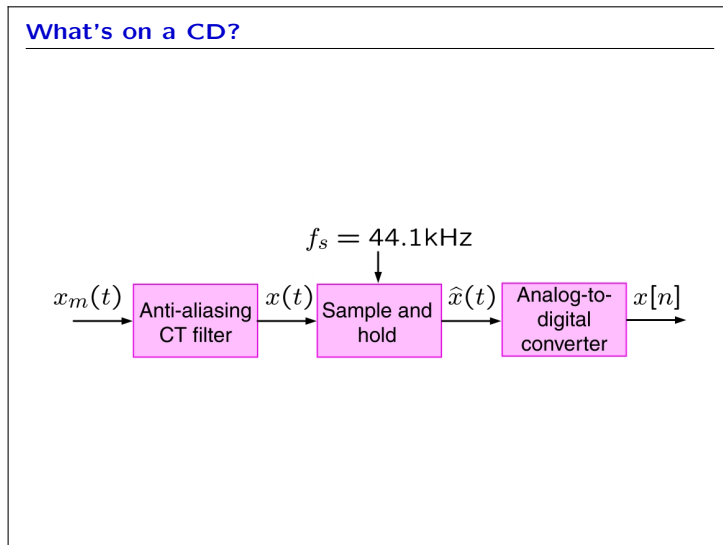
Continuous signal (audio)

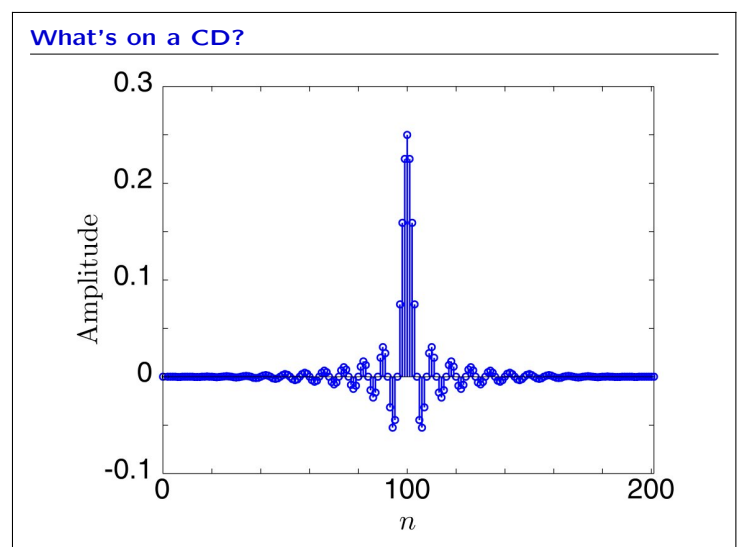
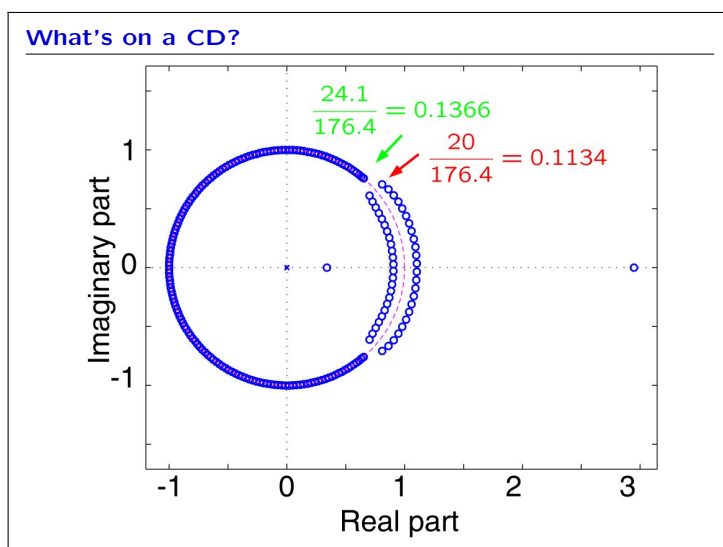
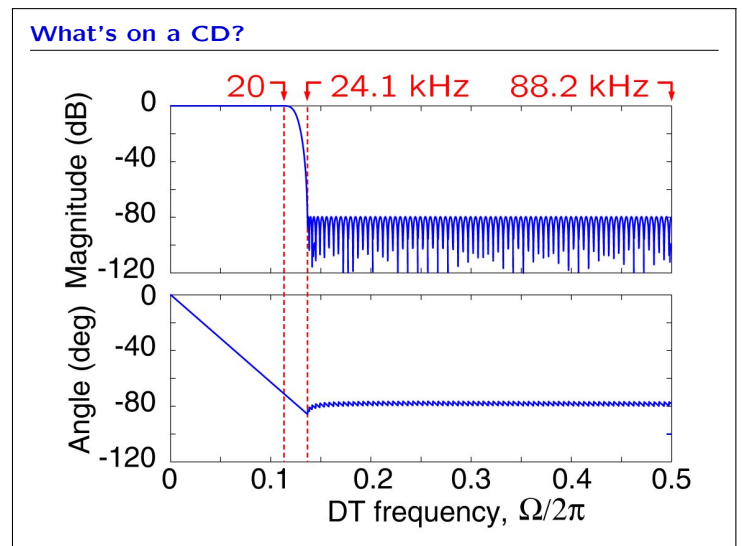
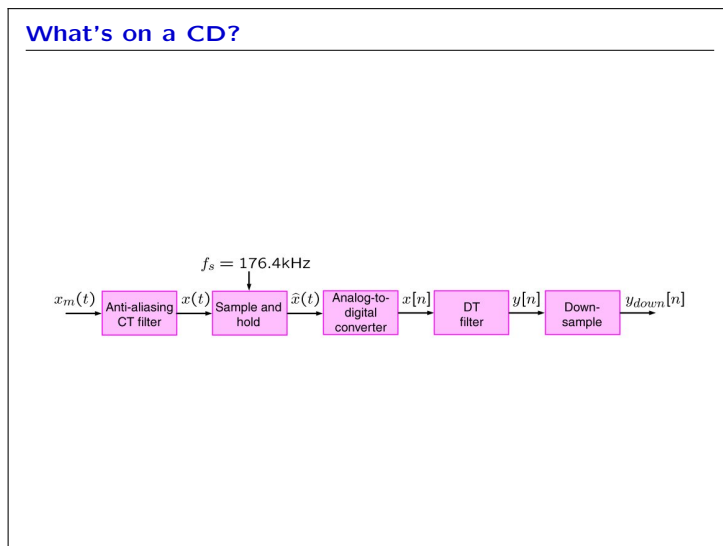
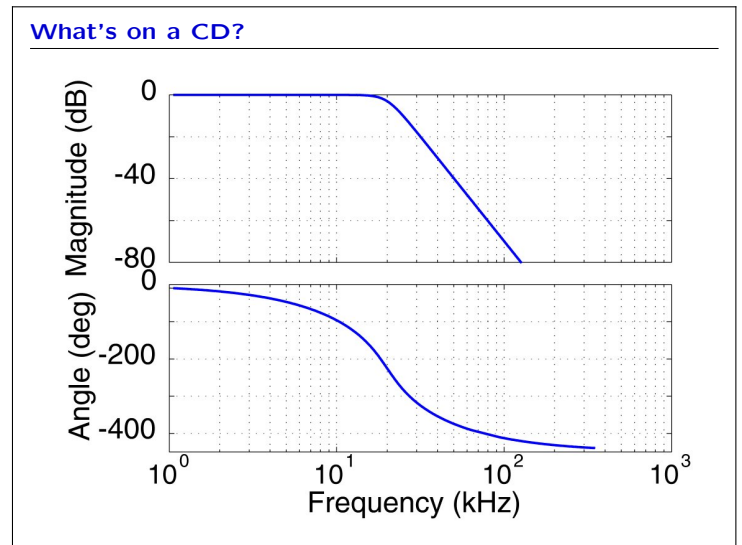
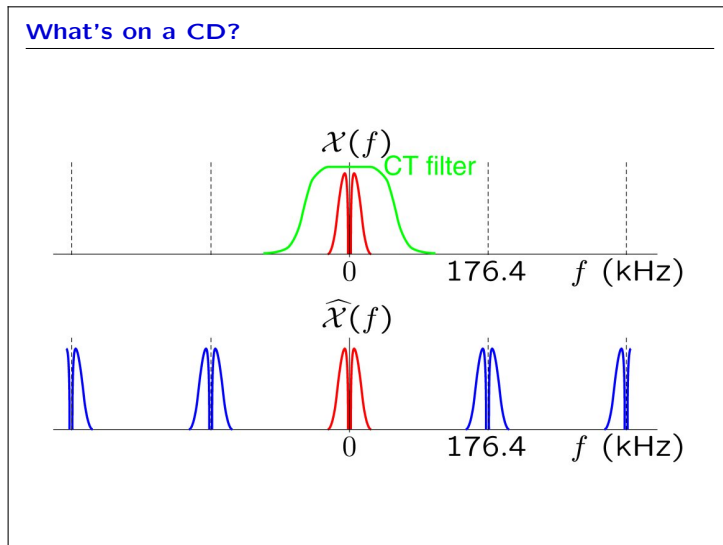
Discrete storage (pits and lands)

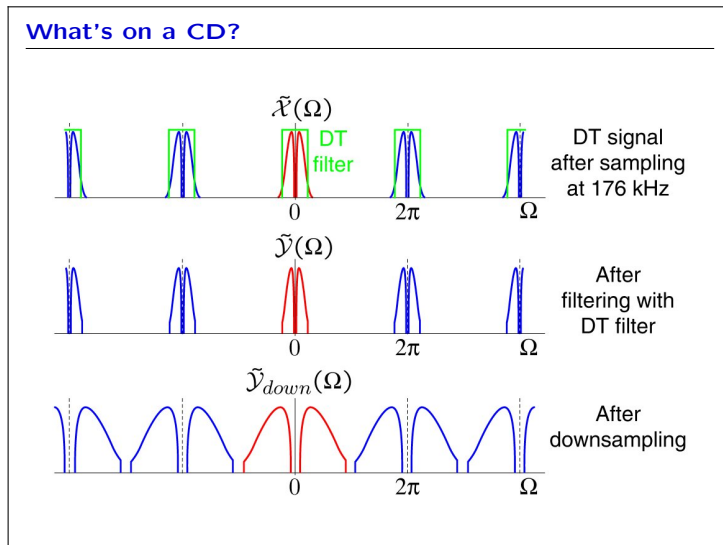
→ sampling!

What's on a CD?









What's on a CD?

LPs: 100 years of optimization, good fidelity, but

- fragile: easily scratched
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- nearly indestructible ✓✓
- very low distortion ✓✓
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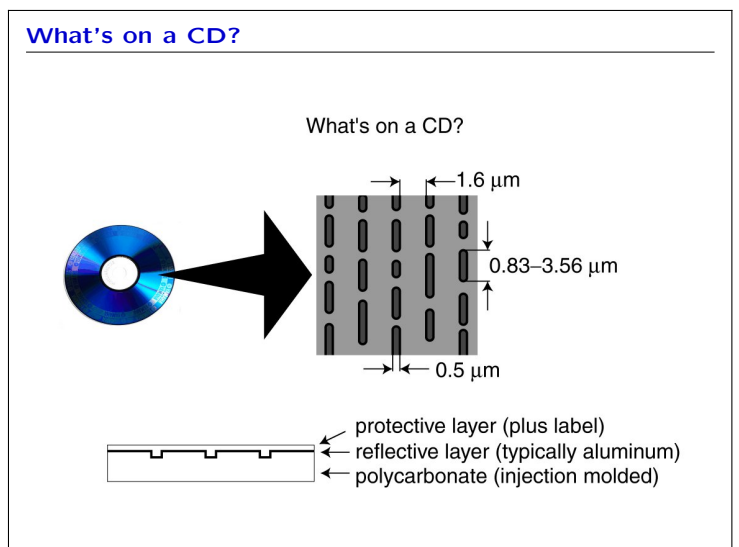
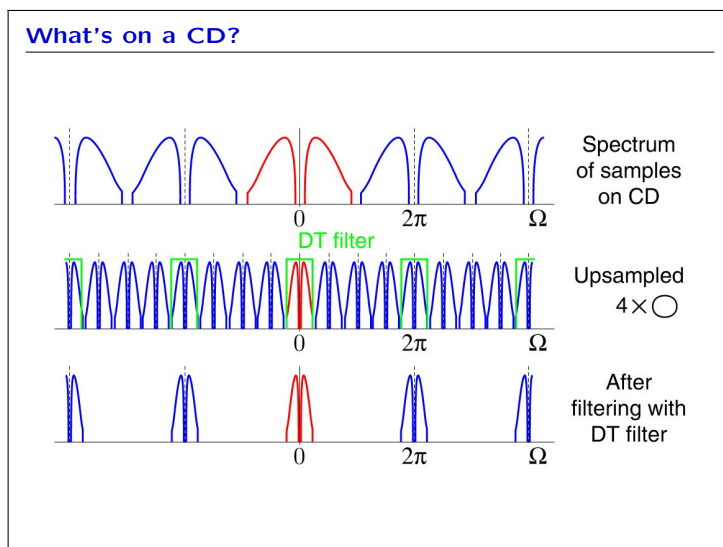
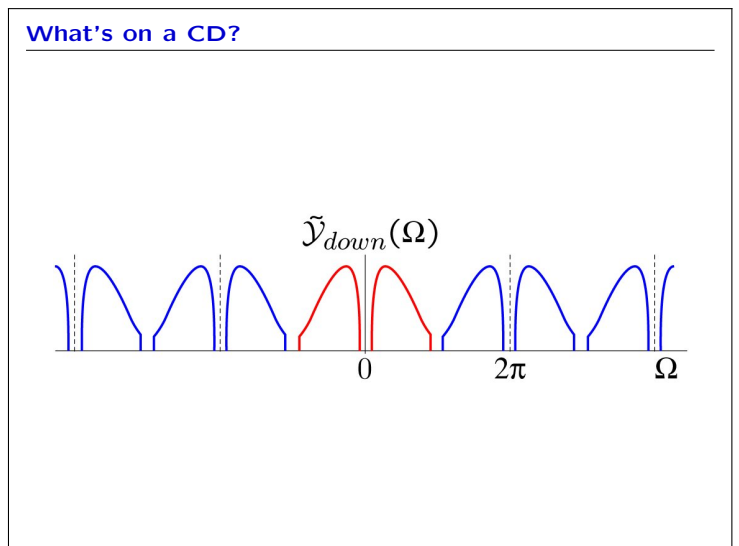
→ many of these advantages made possible by concepts from Signals and Systems!

What's on a CD?

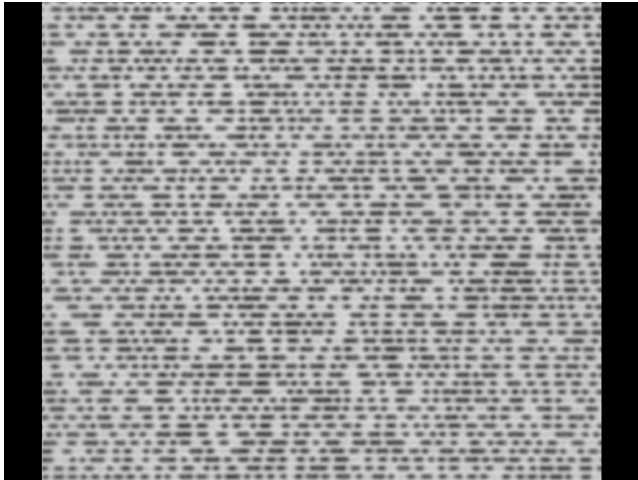
Audio → bits:

- sampling
- filtering
- DT processing of CT signals
- downsampling

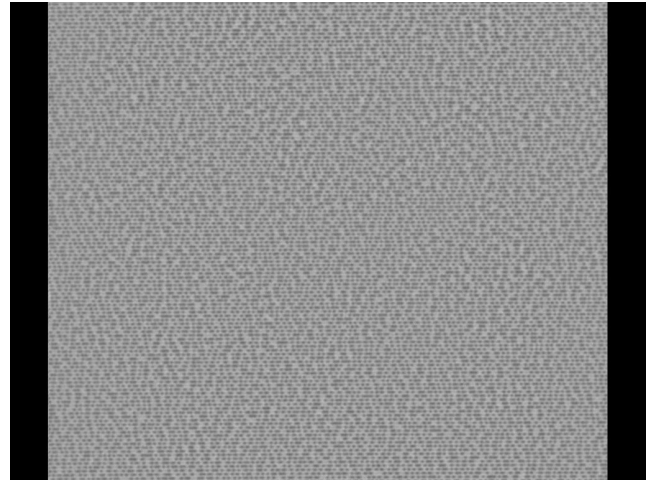
Next issue: how to you build a player?



What's on a CD?

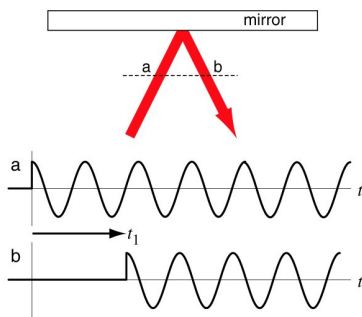


What's on a CD?



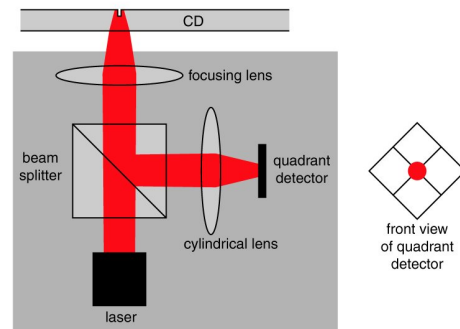
What's on a CD?

Interferometric sensing: 6.003 explanation



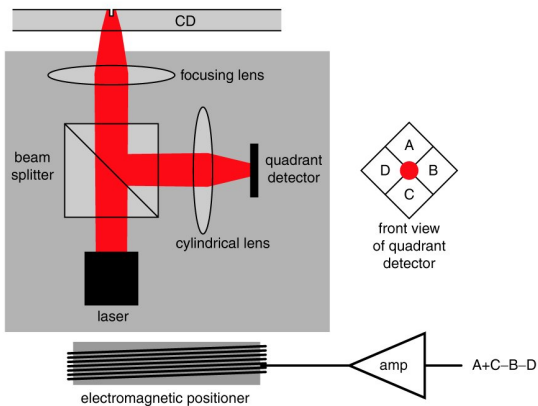
What's on a CD?

Focusing with feedback control

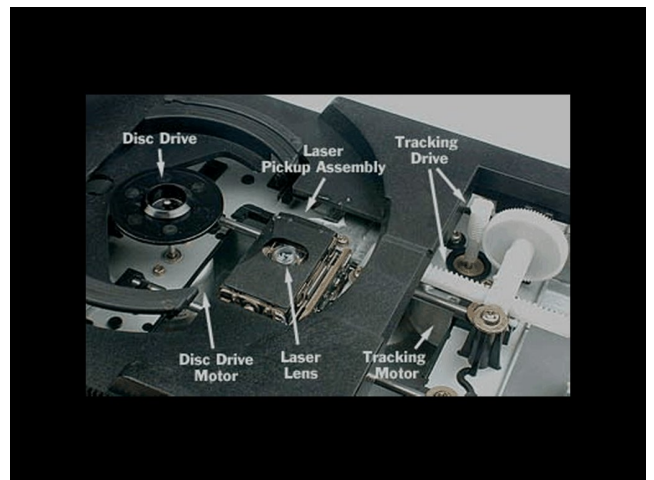


What's on a CD?

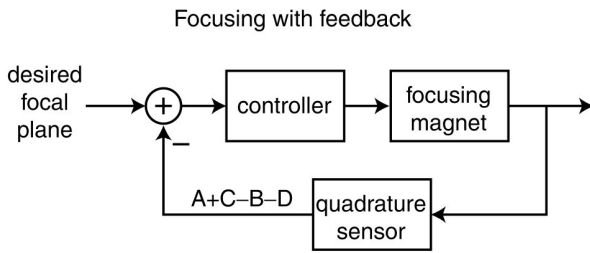
Focusing with feedback control



What's on a CD?

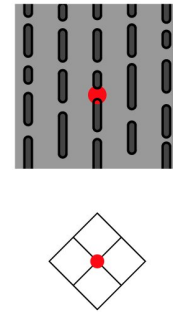


What's on a CD?



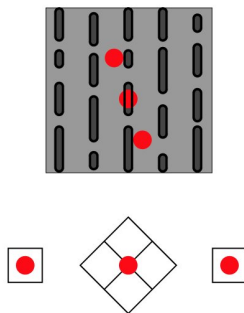
What's on a CD?

Translating pits to bits

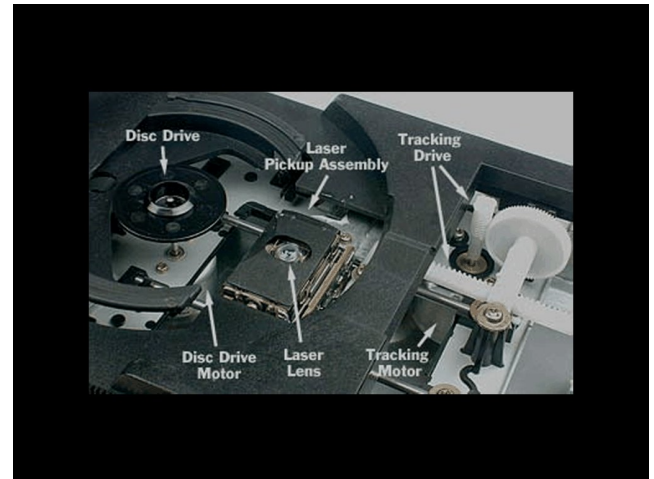


What's on a CD?

Tracking with feedback control

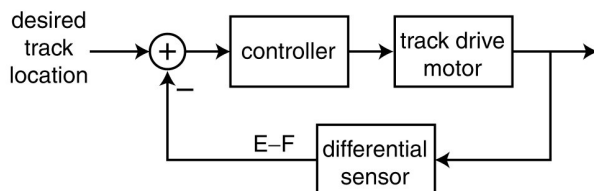


What's on a CD?



What's on a CD?

Tracking the tracks with feedback



What's on a CD?

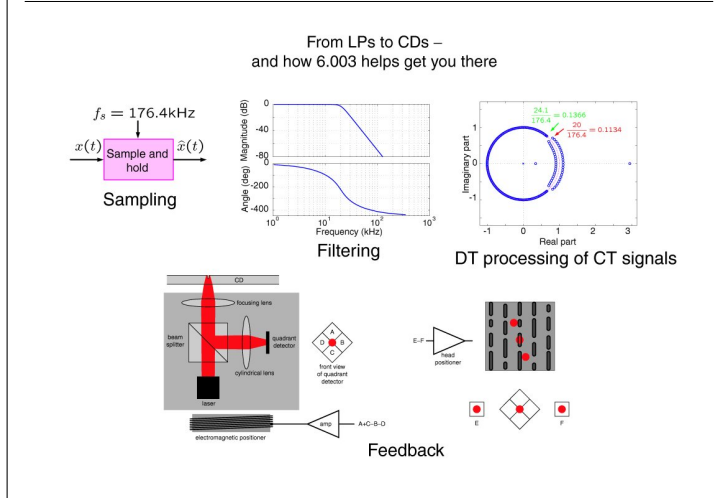
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What's on a CD?



What's on a CD?

References:

"The History of the Edison Cylinder Phonograph"
<http://memory.loc.gov/ammem/edhtml/edcylldr.html>

"Audio Compact Disk -- An Introduction" by Kelin J. Kuhn
<http://www.ee.washington.edu/conselec/CE/kuhn/cdaudio/95x6.htm>

"How CDs Work" by Marshall Brain
<http://electronics.howstuffworks.com/cd.htm>