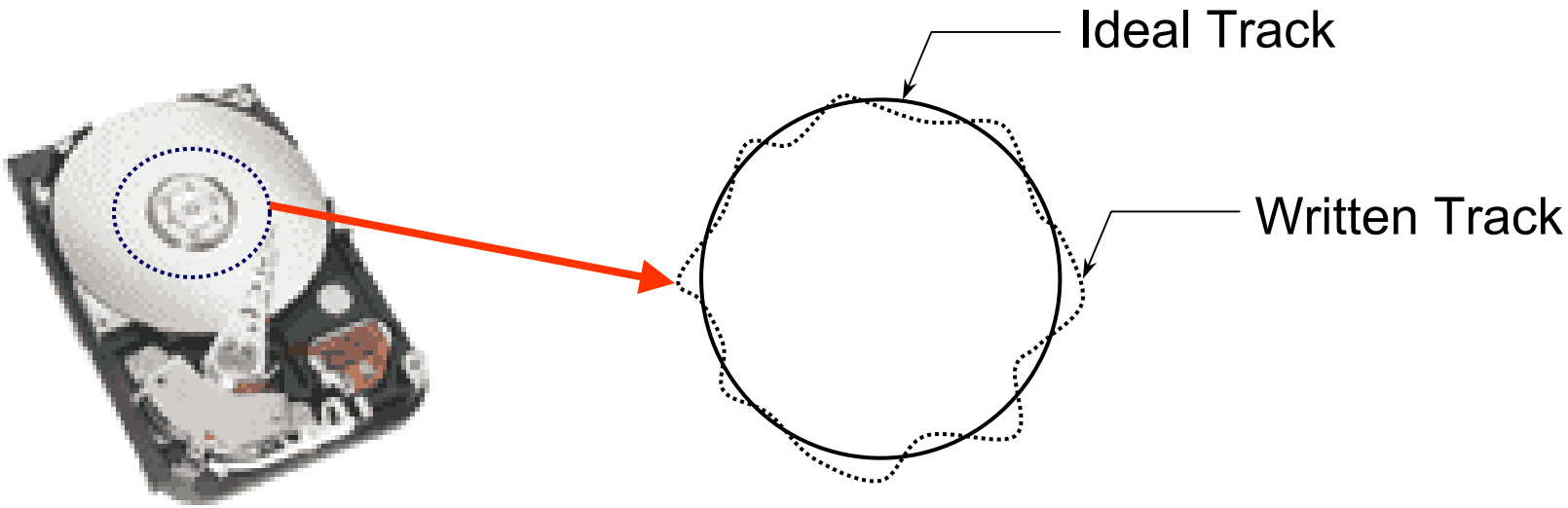
A Nonstandard Approach to Use of RC to Allow More Dense Storage in Computer Disk Drives

Servo Tracks in Disc Drive



- Position error during the track writing process results in imperfect circular tracks, due to external vibration, variation in mechanical geometry, track writer positing error, etc.
- Written-in position error is implicitly sampled at each servo sector.
- Frequency spectrum of written-in position error will consist of discrete frequencies that are integer multiples of the spindle frequency.

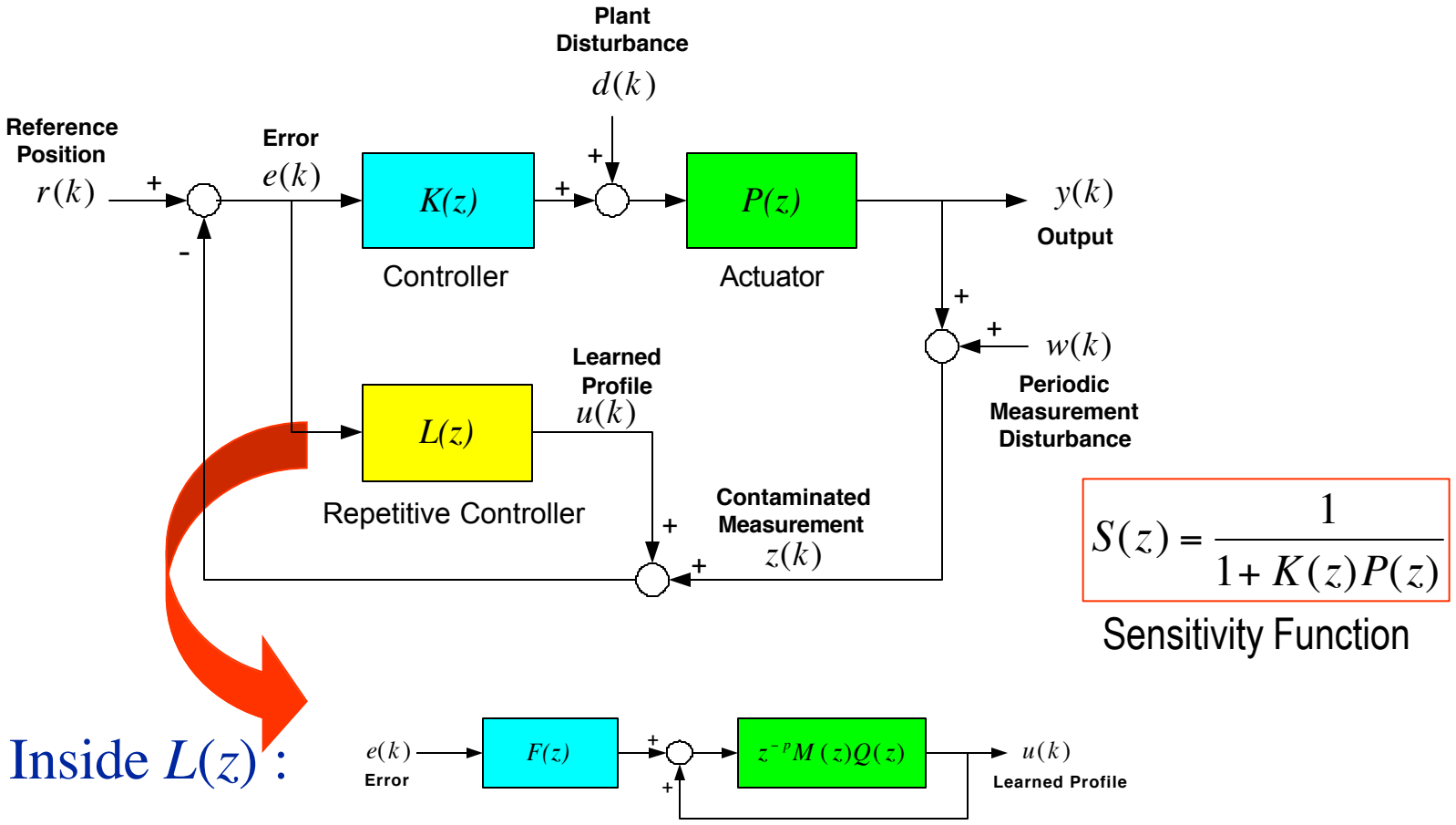
RRO, NRRO, and PES

- PES (Position Error Signal) contains
  - Repeatable Runout (RRO)
  - Non-Repeatable Runout (NRRO)
- The statistical 3-σ values of RRO, NRRO, and PES are used as performance indexes

$$\sigma_{PES}^2 = \sigma_{RRO}^2 + \sigma_{NRRO}^2$$

- Objective of repetitive controller is to follow a perfect circle of radius equal to the average radius of the track.
- Allows using tighter track density, allowing more data to be stored on

Structure of New Repetitive Controller for Canceling Measurement Disturbances



$$S(z) = \frac{1}{1 + K(z)P(z)}$$

Sensitivity Function

Conclusions

- A non-standard type of repetitive control is developed for canceling periodic measurement disturbances
- Repetitive control law reduces the repeatable runout (RRO) by 98% within 15 revolutions
- This corresponds to a 36% reduction in the 3-σ value of position error signal (PES)