control theory: (SNR)

Noise in the experiment (not necessarily optical)

temp, mirrors' beam pointing vibration, laser freq., laser intensity.

two approaches: 1. Passively isolate.

2. Actively stabilize ⇒ control feedback.

Getting 20 dB at low freq. ⇒ trivial!

classically no problem ⇒ measuring a physical parameter does not affect it's value

⇒ Quantum strategy: measure the deviation from desired value and correct. ⇒ closed loop.

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note: Qm this strategy will not work.

e.g.: don't try to feedback to reduce shot noise

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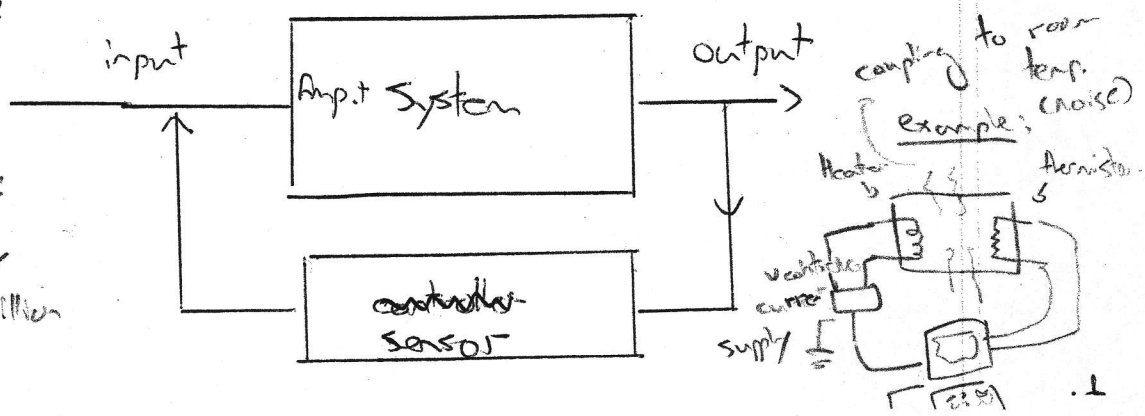
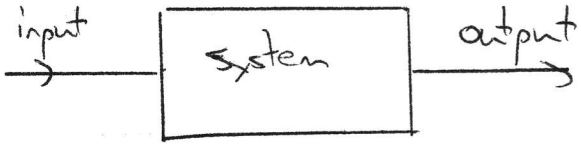
closed-loop:



How should we, mathematically, describe a closed loop system?

let's examine the simpler case,

How do we, mathematically, describe systems:



input : $x(t)$ output $y(t)$

- input and output not necessarily the same units.

limit to linear, time invariant Diff. eq. systems:

$$\sum_{i=0}^{n} y^{(n-i)} a_i = a_0 y^{(n)} + a_1 y^{(n-1)} + \dots + a_{n-1}\dot{y} + a_n y =$$

$$= b_0 x^{(m)} + b_1 x^{(m-1)} + \dots + b_{m-1}\dot{x} + b_m x = \sum_{j=0}^{m} b_j x^{(m-j)}$$

where $y^{(n)} = \frac{d^n y}{dt^n}$ etc.

with linear diff eq. $\Rightarrow$ Laplace transform is a great tool.