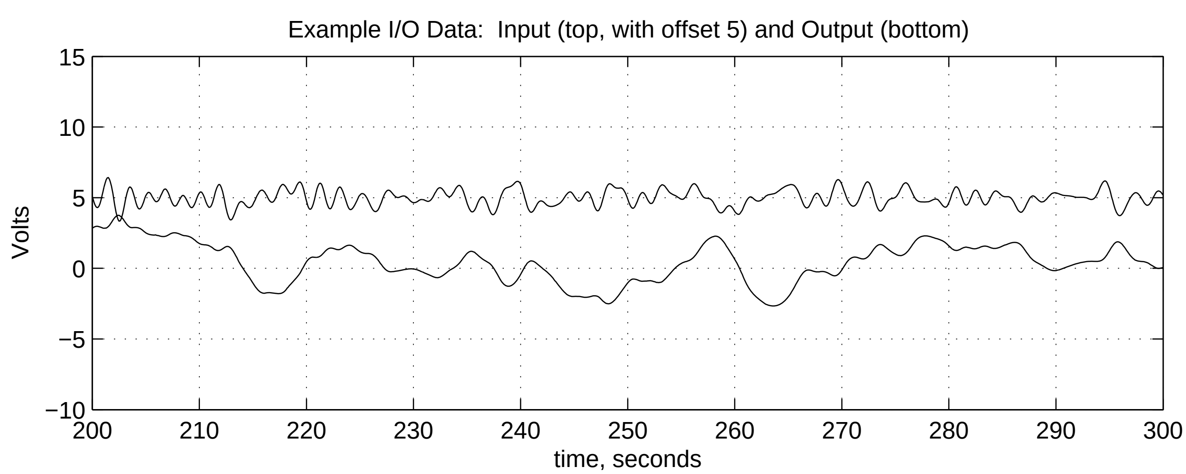
# 31 Identification of a Response Amplitude Operator from Data: Redux

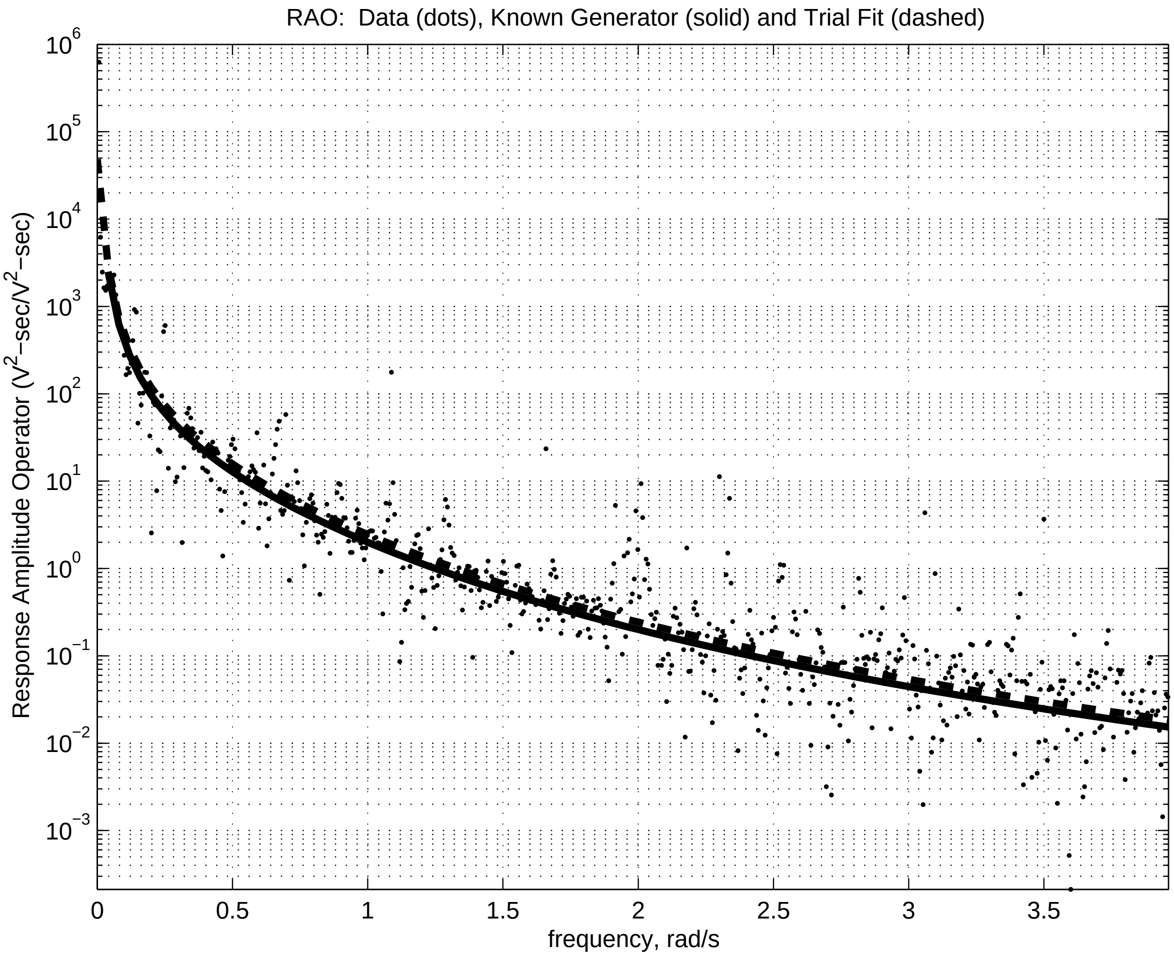
The problem here is almost exactly the same as in HW5, for which you have the full solution. The only differences are:

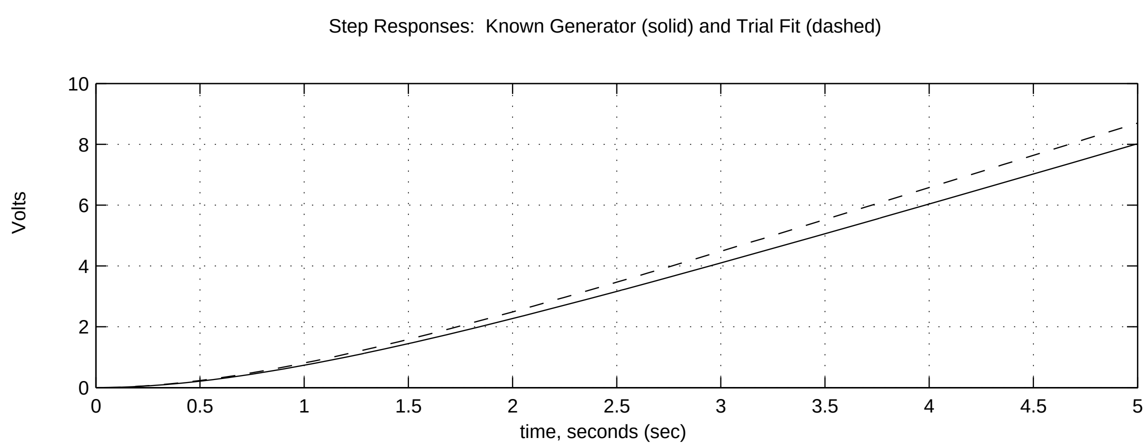
- Load the file `homework7.dat` from course website.
- The frequency range of interest is now up to $4rad/s$, whereas before it was $2rad/s$.
- The noise levels on $u$ and $y$ are lower.
- Just looking at the input and output time plots, you can see that the dynamical system at work here is different. However, it is still second-order, and definitely does not have a zero: $y'' + by' + cy = ku$ describes it. Your task is (again) to find the best fits for $[b, c, k]$ based on the RAO plot, list the transfer function, and show the step response.

*See the attached plots, made from virtually the same code as in HW5. The generating transfer function is* $G(j\omega) = 2/(-\omega^2 + j\omega)$, $[b, c, k] = [1, 0, 2]$, *and the trial fit shown is* $G(j\omega) = 2.2/(-\omega^2 + j\omega + 0.01)$, $[b, c, k] = [1, 0.01, 2.2]$. *This is a low-pass system, in which any low-frequency input is greatly amplified. You can see this behavior directly the transfer function, where the denominator heads toward zero as* $\omega \to 0$, *and the transfer function gets arbitrarily large.*

*Note that I did not use the same data as in the file* `homework7.dat`, *for these solutions.*




RAO: Data (dots), Known Generator (solid) and Trial Fit (dashed)
Response Amplitude Operator (V²–sec/V²–sec)
10⁶
10⁵
10⁴
10³
10²
10¹
10⁰
10⁻¹
10⁻²
10⁻³
0
0.5
1
1.5
2
2.5
3
3.5
frequency, rad/s


Step Responses: Known Generator (solid) and Trial Fit (dashed)
Volts
10
8
6
4
2
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
time, seconds (sec)

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