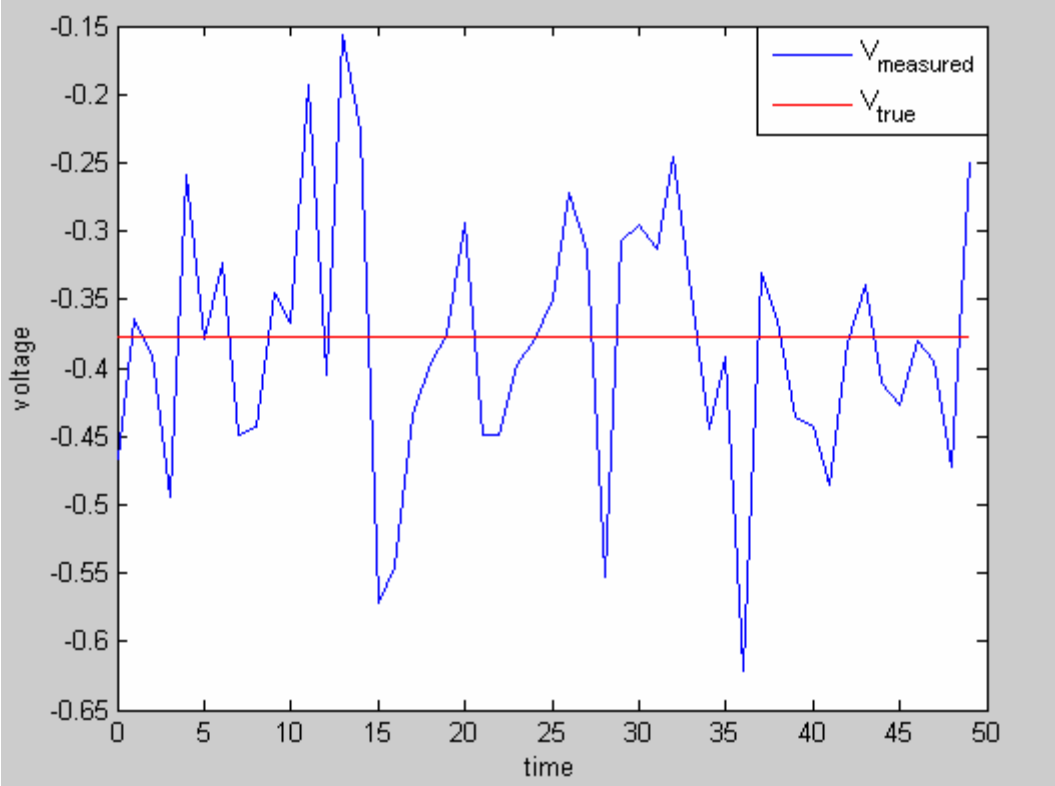
Homework 1 – Kalman Filter

Let's assume we have the ability to measure voltage from a supply, but that this measurement is corrupted by 0.1 volt RMS *white* noise (e.g. our analog to digital converter is not very accurate). Below is a graph of the true voltage and the measured voltage.



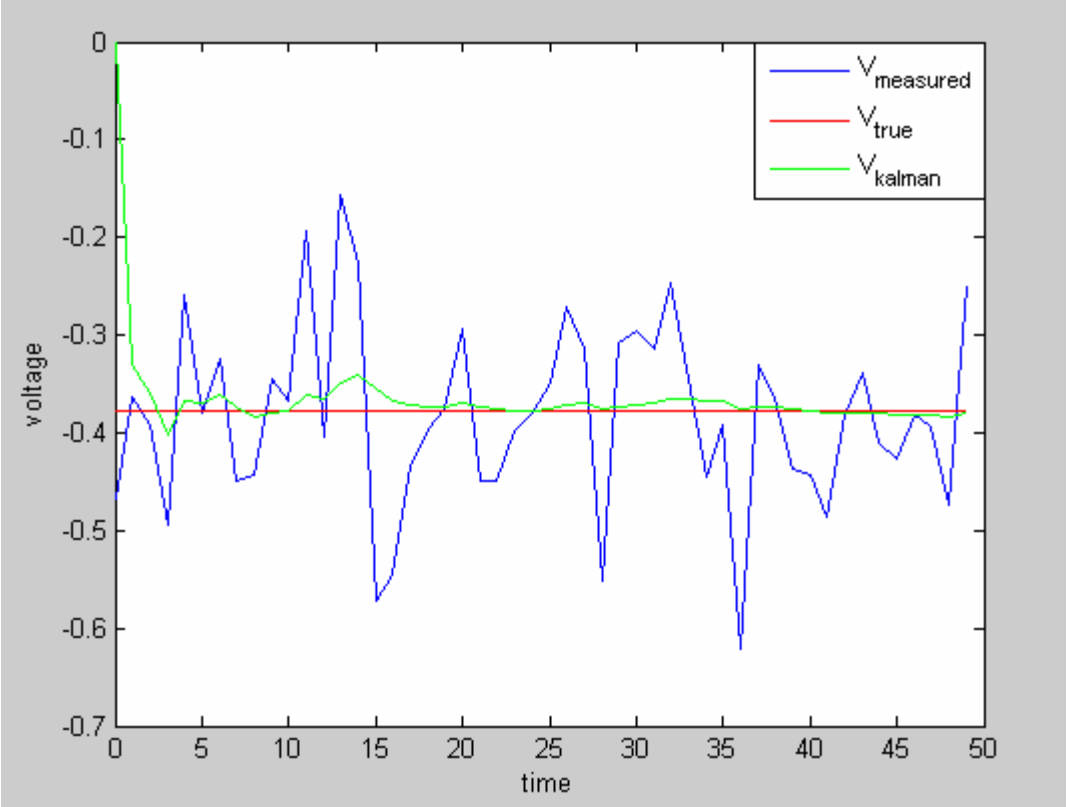
1. Implement a Kalman filter in MATLAB on the measured voltage data from above (data.m can be downloaded from the course web site). Do not use any built-in MATLAB functions for this exercise. Use the following values when implementing your filter: (20 points)

```
A = 1;          % the state does not change
B = 0;          % there is no control input
H = 1;          % our voltage measurement, z_k, is of the state directly

Q = 0.00001;    % let's assume a small process variance
R = 0.01;

xhat(1) = 0;
P(1) = 1;       % if we're certain about xhat(1)=0 then P(1)=0
```

With 50 iterations (i.e. k=1 to k=50), your filtered data should look like the following:



2. Play around with the value of R by increasing and decreasing it to R = 10 and R = 0.0001. Replot your results. Describe the differences between the plot above and the two generated in this step. Why do you think R=0.01 gives the best results? (5 points)