Post processing of measured data; some calibration of signals

Steering wheel angle gain and offset

First we want to roughly calibrate the steering wheel angle signals that we feed into Adams car ant the bicycle model. We have at least one measurement file where the steering wheel has been turned to known values such as 0,180 and 160 degrees.

If the steering angles is plotted it can be seen that both gain and some offset is required so that the steering angle is correctly measured. In figure 1 the original and corrected steering angle with added offset and gain can be seen.

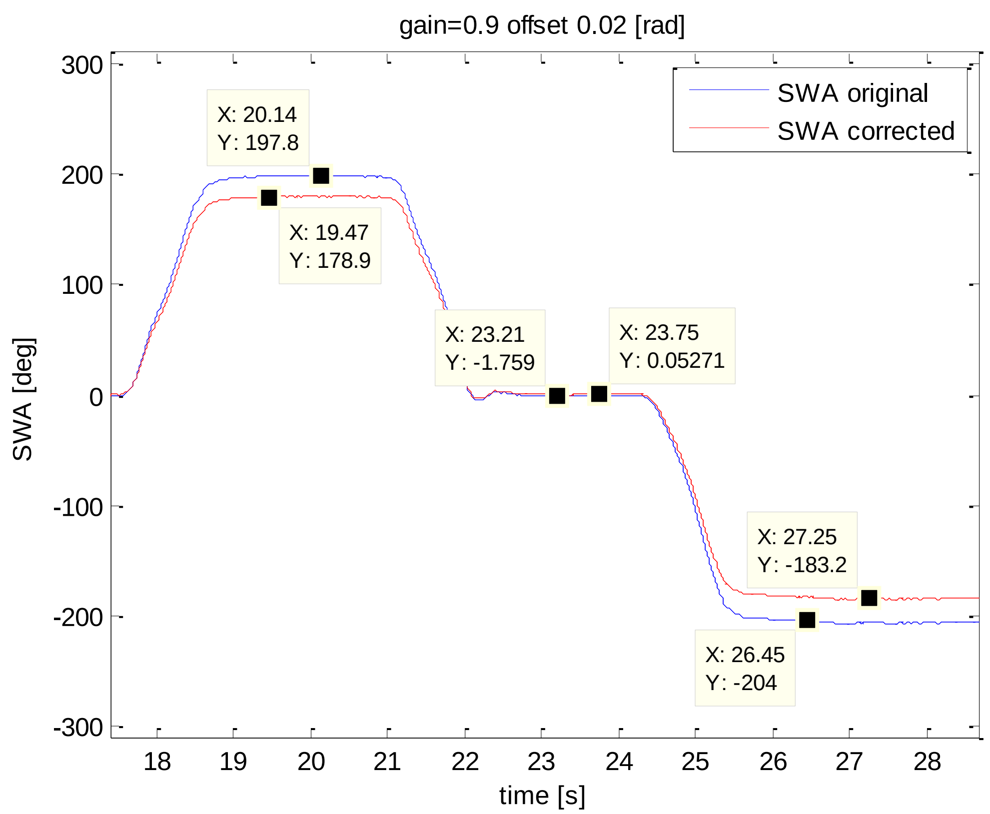

Figure 1: Example of original and adjusted steering wheel angle during post processing in matlab.

Picking out the data interval

The measurement does not always start at exactly the right time and you can often see that a measurement is started in the middle of a curve. See figure 2. It can then be good to select a starting index and an ending index to create a new starting and ending point for the selected part that we wish to study.

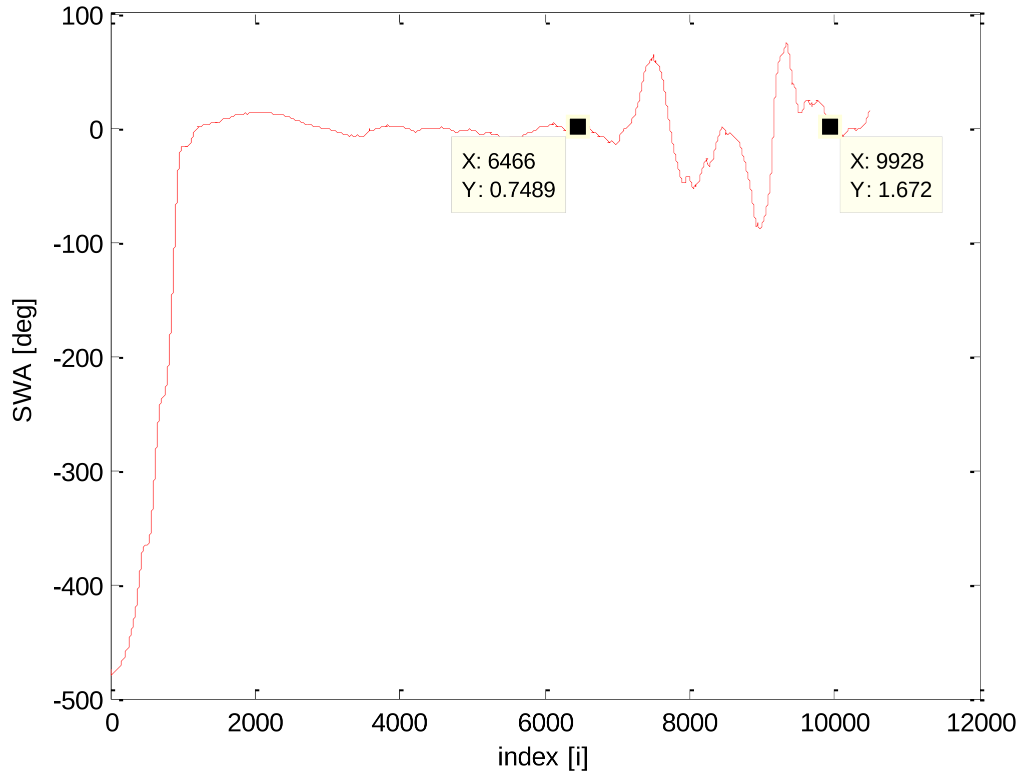

Figure 2: full measurement with a lot of unnecessary data in the beginning.

For this example the starting index i0 = 6466 and i1 = 9928 will be used.

```
time = file_data(i0:i1,1)-file_data(i0,1);
delta = file_data(i0:i1,8)*swgain+swoffset;
vx = file_data(i0:i1,9);
yaw_rate = file_data(i0:i1,2)*yawgain+yawoffset;
ay = file_data(i0:i1,7)*aygain+ayoffset;
roll_rate = file_data(i0:i1,4)*rollgain+rolloffset;
```

Figure 3 shows the selected data.

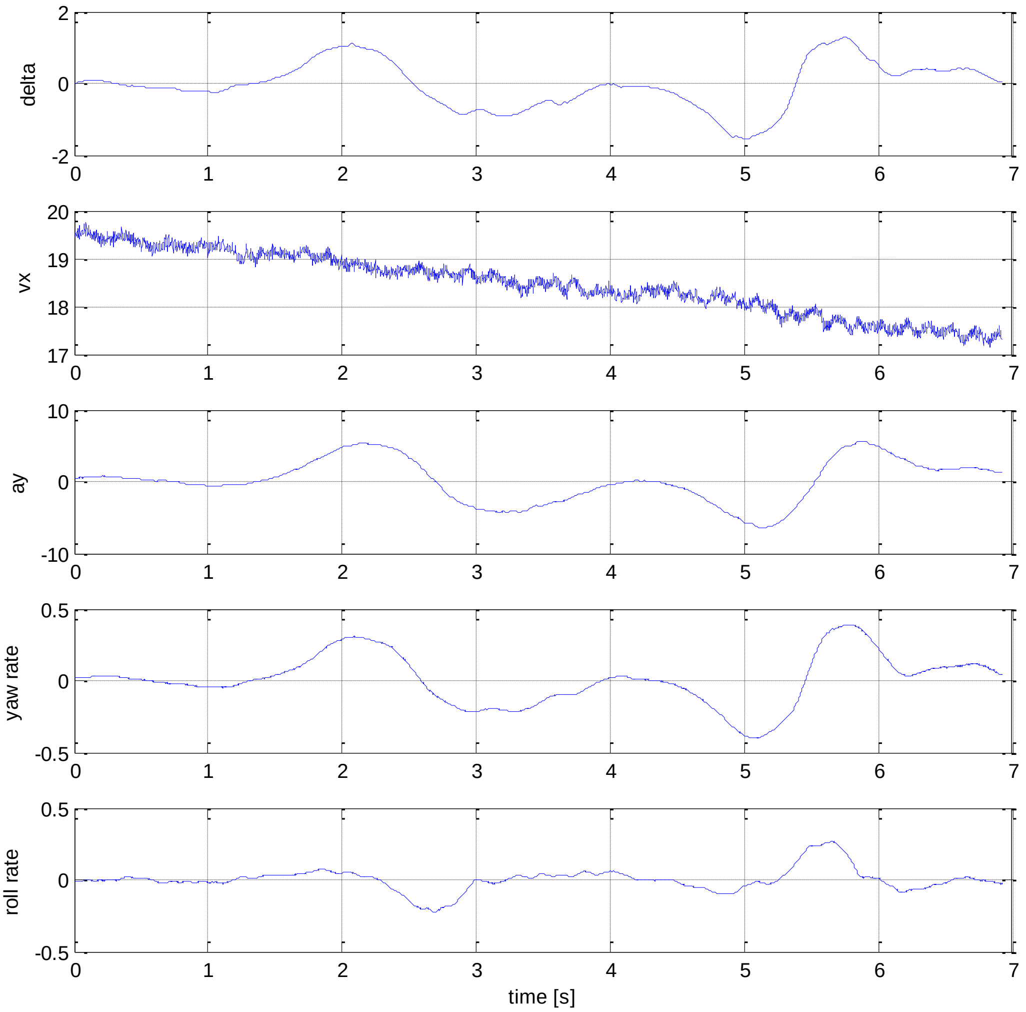

Figure 3: Selected data from the measurements

Integrating the signals

To be able to study the vehicle trajectory and vehicle roll angle some of the signals need to be integrated.

```
for i=2:length(time)
    dt=time(i)-time(i-1);
    roll_angle(i)=roll_angle(i-1)+roll_rate(i)*dt;
    yaw_angle(i)=yaw_angle(i-1)+yaw_rate(i)*dt;
    vy(i)=vy(i-1)+(ay(i)-yaw_rate(i)*vx(i))*dt;
    x(i)=x(i-1)+vy(i)*sin(yaw_angle(i))*dt+vx(i)*cos(yaw_angle(i))*dt;
    y(i)=y(i-1)+vy(i)*cos(yaw_angle(i))*dt+vx(i)*sin(yaw_angle(i))*dt;
end
```

x,y,yaw_angle and roll_angle all have to be given initial values.

Then we have to do some extra calibration so that the integrated signals end up at the right value. Staring with roll angle by simply adjusting the value `rolloffset` the integrated roll angle can be adjusted so that it ends up at 0 degrees at the end of the maneuver. The same goes for yaw and lateral acceleration. Note that when calculating the lateral velocity vy, the calculation also contains yaw rate and vehicle forward velocity vx.

Global vehicle positions x and y are also calculated by integrating the velocities and angles. Figure 4 shows the final integrated signals and in which direction the signals will shift by adjusting the offset values.

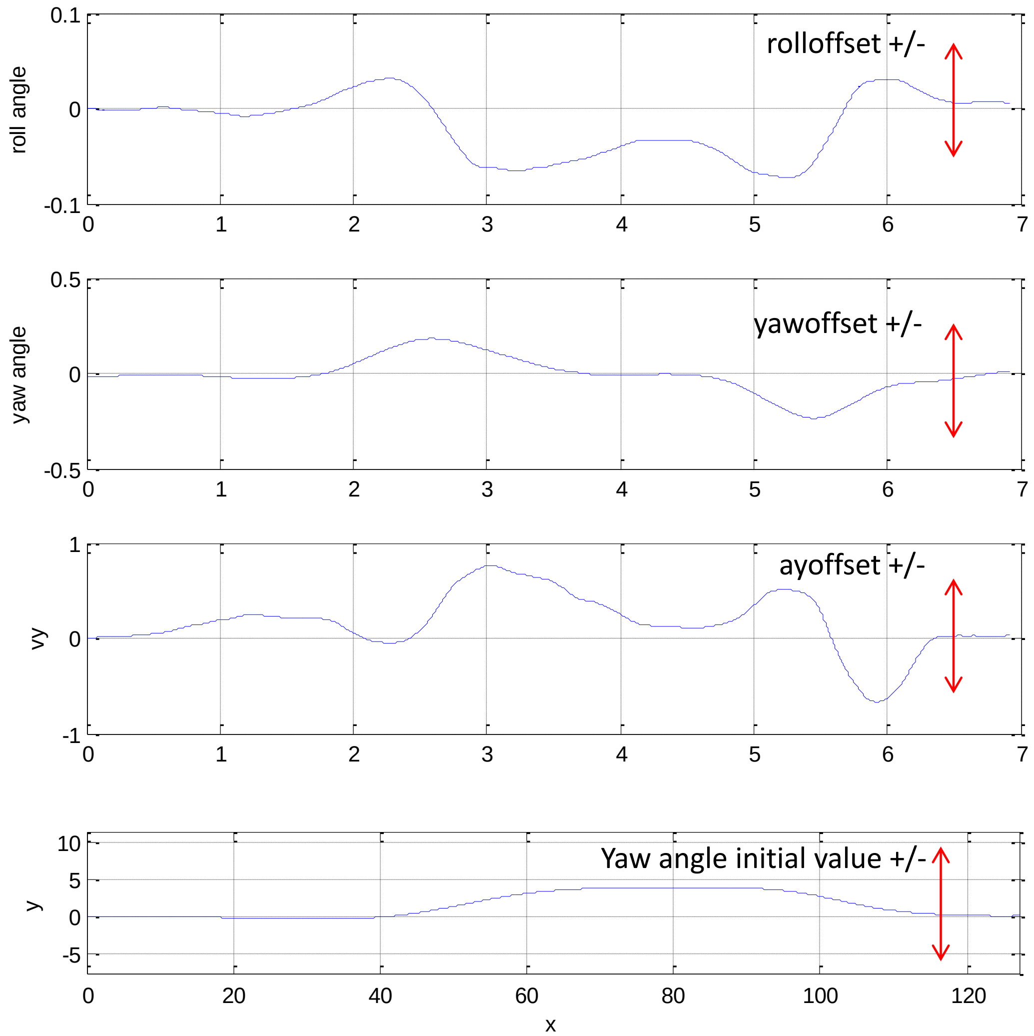

Figure 4: integrated signals of roll and yaw angle, lateral velocity and final vehicle global trajectory