Calibration rules for flow vector measurement assembly

Test flight **24-03-2017, V3 kite, KCU1**. Data processed in MSc-thesis Johannes Oehler

Sideslip angle β: positive when inflow is from the right side w.r.t. forward view

Vertical inflow angle α_m: positive when inflow comes from below

$\beta = (0{,}222513 - \frac{U1}{Uref}) \frac{180}{0{,}24736}$ U1 is signal voltage for sideslip angle

$\alpha = (\frac{U2}{Uref} - 0{,}303865) \frac{180}{0{,}252629}$ U2 is signal voltage for vertical inflow angle

Air density ρ and total magnitude of flow velocity v_a

$\rho = \frac{p_{baro} - 370Pa}{R(284{,}4K - 0{,}01\frac{K}{m}(alt - 330m)}$ 284,4K was temperature at 330m altitude

$v_a = \sqrt{\frac{2*(\Delta p_{pitot} + 30Pa)}{\rho * 0{,}971}}$ 0,971 is pitot correction obtained in Windtunnel

Matlab code: X=CSV-data

```
beta=(0.222513-X(:,8)./X(:,10))*180/0.24736;
betasmooth=smooth(beta,11);


alpha=(X(:,9)./X(:,10)-0.303865)*180/0.2526286;
alphasmooth=smooth(alpha,11);
```

For both angles smoothing over 0,5s minimum should be applied (11 datapoints at 20Hz) to dampen voltage oscillation noise.

```
R=287.06;
smoothDiffPressure=smooth(X(start:ende,6),21,'rlowess');
density=(100*X(start:ende,7)-370)/R./(284.4-.01.*(X(start:ende,16)-330));
density=smooth(density,21);
vA=real(sqrt(2*(smoothDiffPressure+30)./density/.971));
```