

Adaptive filtering (Kalman filtering)

The XEN-1210 exhibits a low level of magnetic noise. A simple adaptive low-pass filter can be used to further reduce this noise. The filter can be used for the 3D magnetic vector per separate axis.

A simple recursive low-pass filter is described by the following formula:

$$\text{Prediction}_n = \text{Factor}_n * \text{Sample}_n + (1 - \text{Factor}_n) * \text{Prediction}_{n-1}$$

Factor_n is now made adaptable and increases with a change in signal. The effect of this action is that the output of the filter tends to follow the input signal in case of a signal change, but to filter out the noise when there is no change.

Such action can for example be established using the following algorithm:

$$\text{Factor}_n = \text{ABS}((\text{Sample}_n - \text{Prediction}_{n-1}) / \text{Sensitivity})$$

For filter stability Factor_n has to remain between zero and one:

$$0 < \text{Factor}_n < 1$$

The higher the sensitivity, the lower the static bandwidth of the filter, but the slower the reaction on a direction change. A good average value of the sensitivity is 8.

In case this filter is implemented in an ASIC or limited processing power is available, some simplifications are allowed. First, only allow Sensitivity to be multiples of 2, so that the division is a merely a shift action. Also, Factor_n can be clipped on binary values, so also the multiplications can be a limited set of shifts.

The filter can reduce the noise with a factor of five, without any visible reduction in compass speed.

The use of such an adaptive filter in a feedback system has to be considered carefully and simulations are advised.



General Information

Product Status

The product is in production.

Right to make changes

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Application Information

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These products are not qualified for use in life support applications, aeronautical applications or devices or systems where malfunction of these products can reasonably be expected to result in personal injury

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