Engineering the best design for your sensor data measurement application

(ASN15-PPT001)

Sensor measurement data
the first few steps

- Sensors come in variety of forms: Temperature, light, pressure, strain, level, audio, humidity, biomedical ….

- All sensors produce measurement data.

- Sometimes these data need to be *filtered* in order to remove any *unwanted components* (white noise, 50/60Hz powerline interference, random glitches etc.)

- Signal analysis needed in order to differentiate between the *wanted* and *unwanted* components.

- Analysis and design phase usually requires expensive or even multiple software tools and expert knowledge – very undesirable for many organisations!

Measuring material stress in a wheel hub with a strain gauge loadcell sensor

Strain gauges used to measure material stress in wheel hub when fitted to a car or tractor.
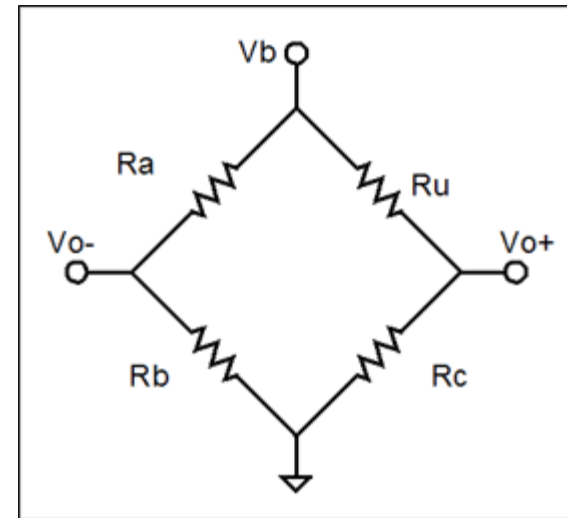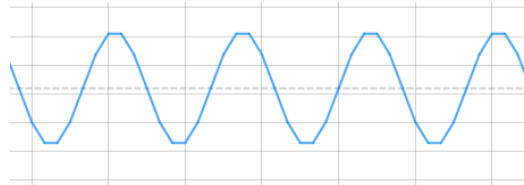

Wheatstone bridge
(strain gauge loadcell comprised of 4 strain gauges)

Sensor measurement data
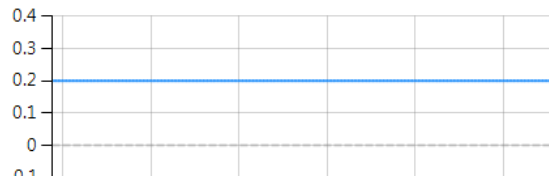## loadcell sensor example

unwanted component

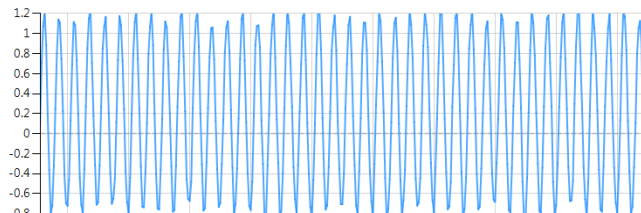50Hz sine (powerline interference)

+

unwanted component

white noise (measurement noise)
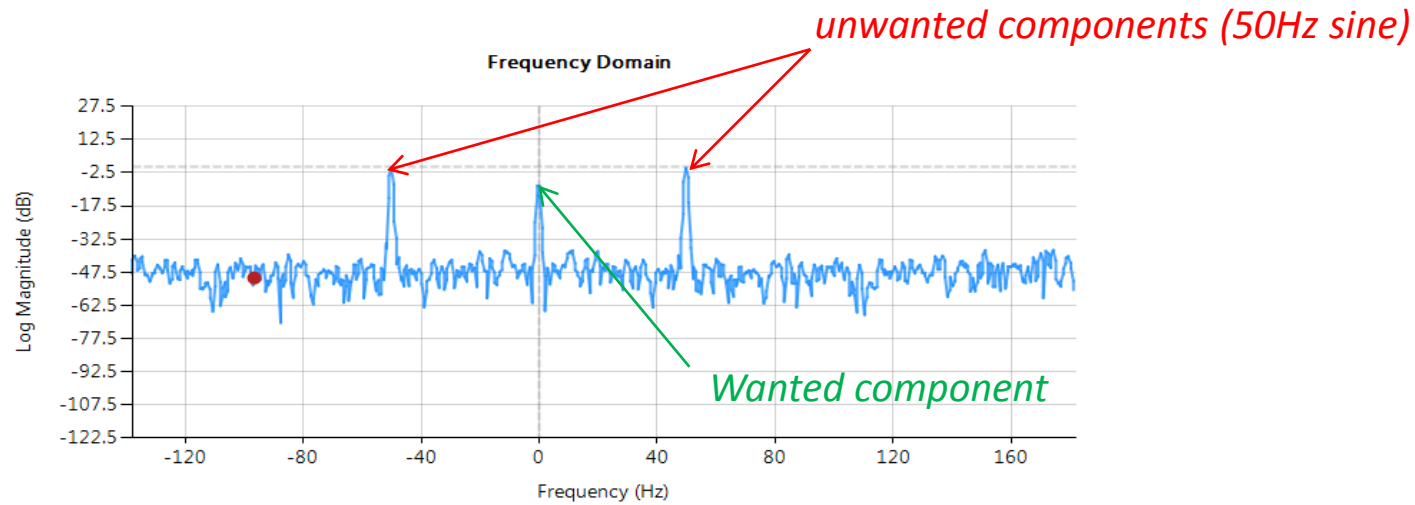
+

Wanted component

desired signal (DC component)

=

net sensor signal

Sensor measurement data

loadcell example: Frequency signal analysis

unwanted components (50Hz sine)

Frequency Domain

Wanted component

Fourier analysis results: we need to attenuate all frequencies ≥ 50Hz

Conclusion: **we need a lowpass filter!**

Sensor measurement data
loadcell example: technical specifications

What type of lowpass filter do we need?

1. IIR (infinite impulse response) or FIR (finite impulse response) ?
2. Which design method do we need?
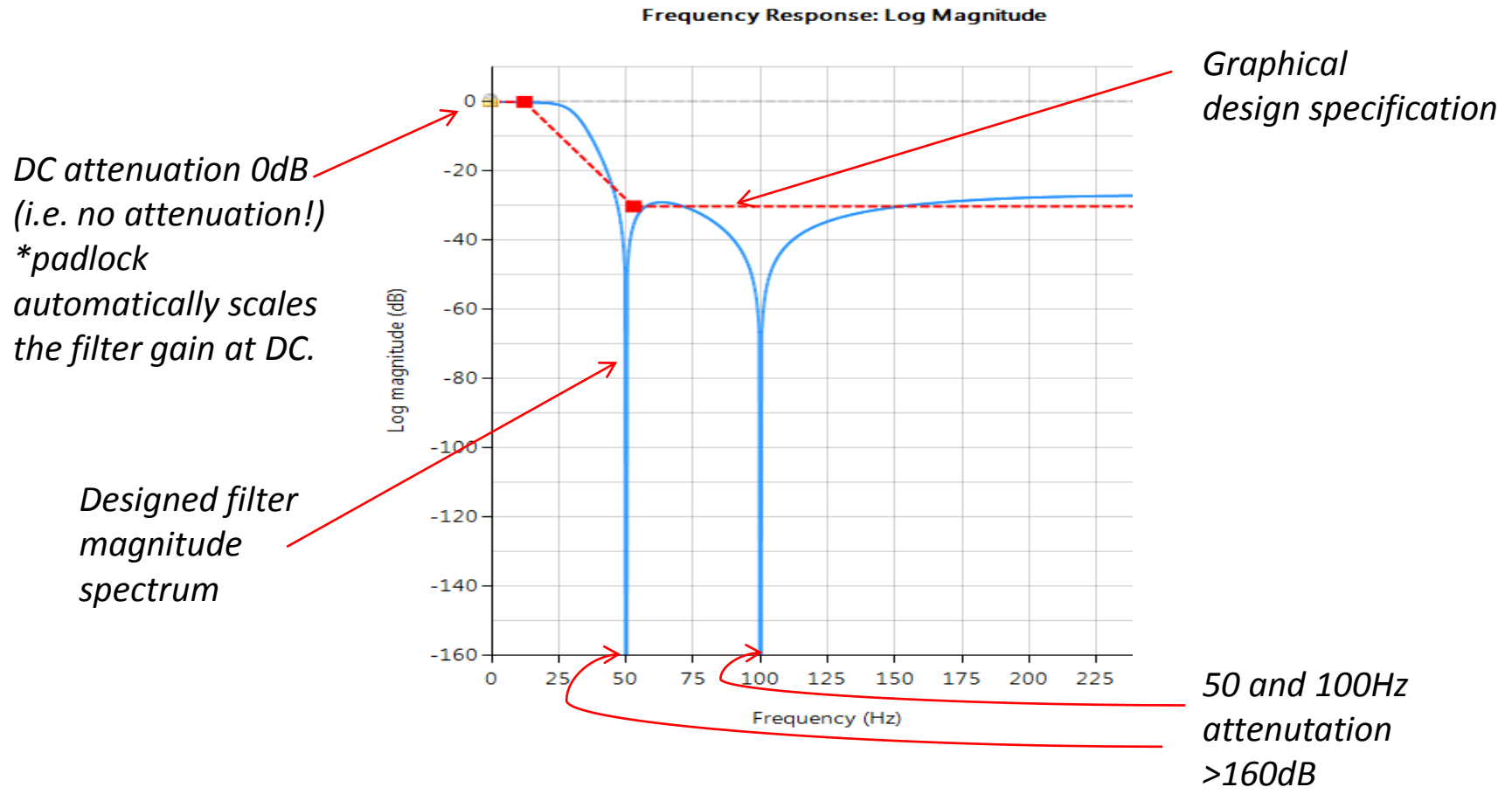3. How do we specify the technical specifications?

▸ Designers hit a 'brickwall' with traditional tooling.

▸ Standard tooling requires an iterative, 'trial and error' approach or expert knowledge.

▸ Considerable amount of valuable engineering time wasted.

Solution! ASN filter designer provides designers with an interactive method of design, whereby the tool automatically enters the technical specifications based on the graphical user requirements.

Sensor measurement data
loadcell example: Interactive lowpass filter design

Frequency Response: Log Magnitude

Graphical design specification

*DC attenuation 0dB (i.e. no attenuation!) *padlock automatically scales the filter gain at DC.*

Designed filter magnitude spectrum

50 and 100Hz attenutation >160dB

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Sensor measurement data
loadcell example: automatic technical specification

Technical specification:
Tool automatically generates a technical specification based on graphical design specification.
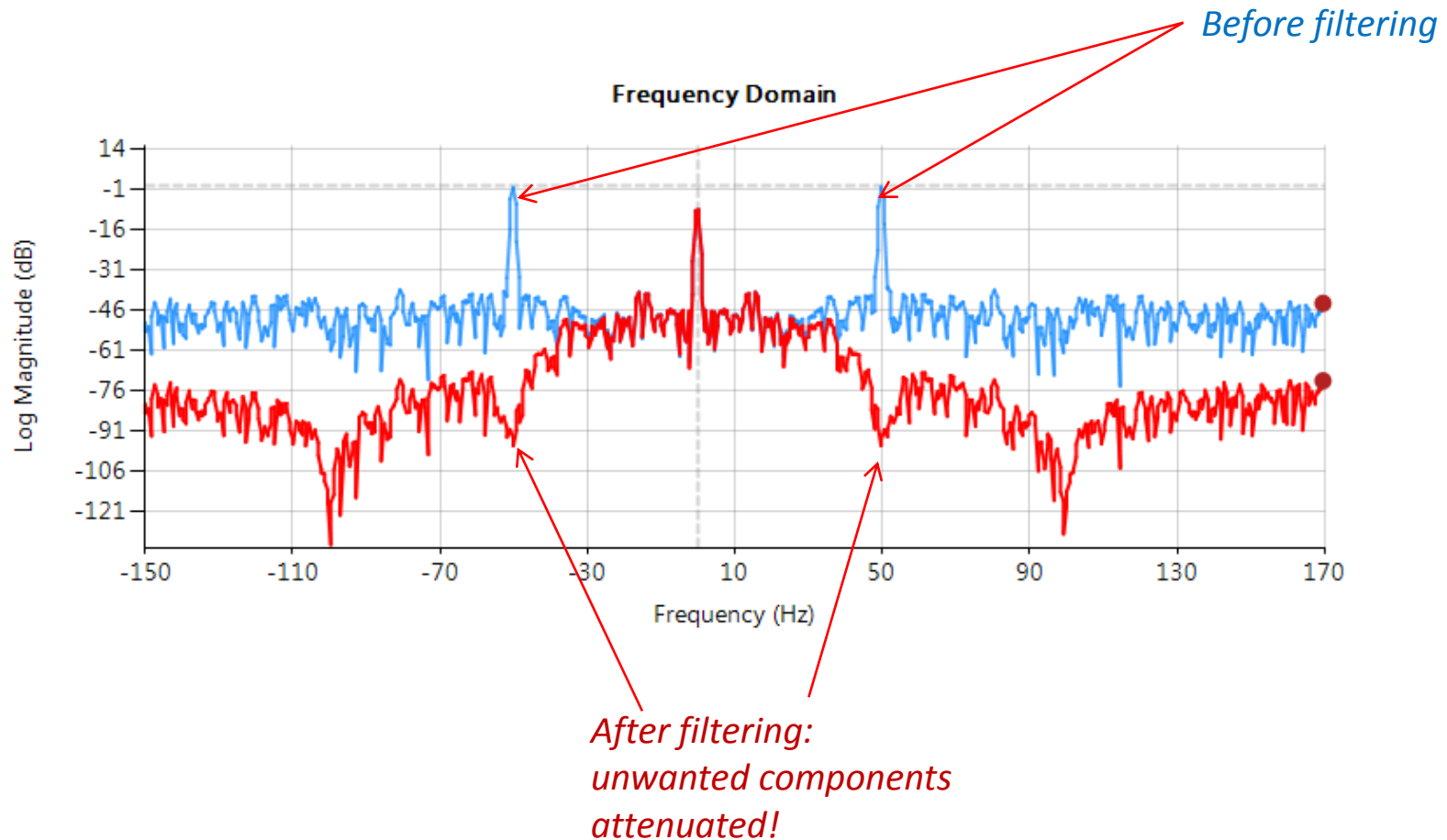

Automatic documentation:
Detailed filter summary of technical specification.

Summary may be exported to Matlab, Scilab, Labview or C for deployment or further analysis.
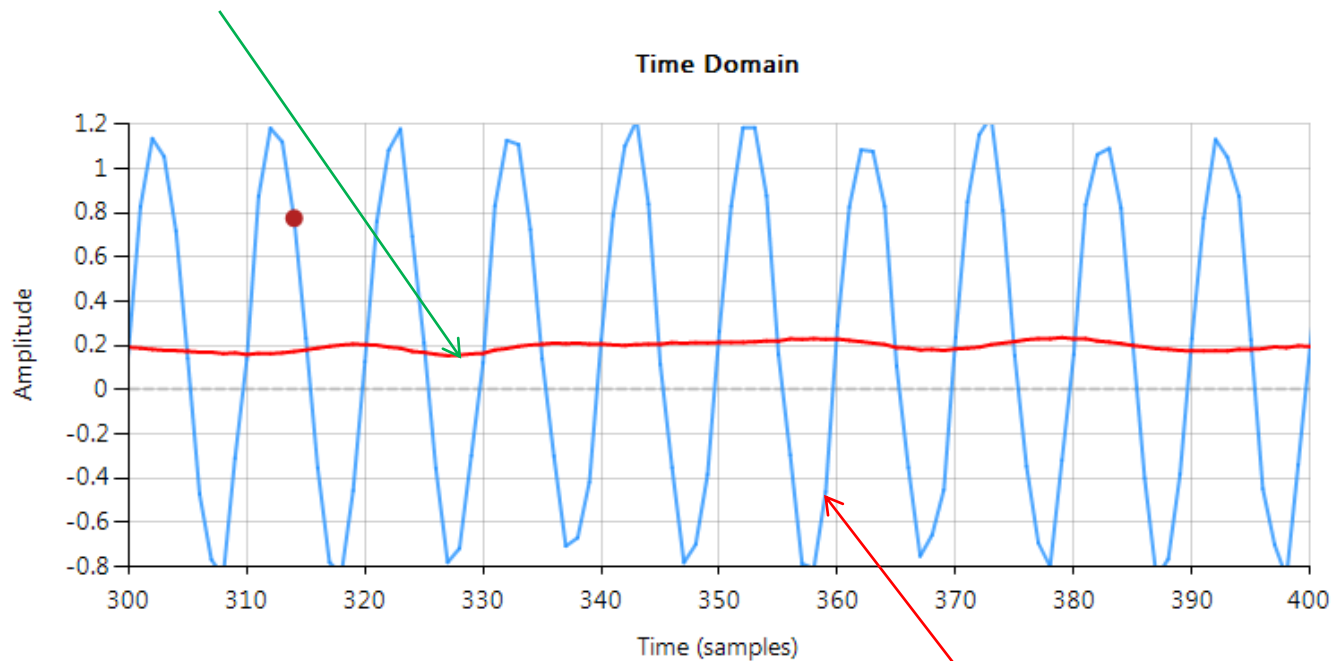
Sensor measurement data

loadcell example: the result (frequency domain)!

Before filtering

Frequency Domain

*After filtering:
unwanted components
attenuated!*

Sensor measurement data

loadcell example: the result (time domain)!

After filtering: Wanted component recovered with no sign of the 50Hz sine and less white noise!

Time Domain

Original signal (before filtering)

Sensor measurement data
loadcell example: conclusions

- **Fully validated filter design**: suitable for deployment in DSP, micro-controller, FPGA, ASIC or PC application.

- **Automatic detailed design documentation**: expediting peer review and lowing project risks by helping the designer create a paper trail.

- **Simple handover**: project file, documentation and test results provide a painless route for handover to colleagues or other teams.

- **Easily accommodate other scenarios in the future**: Design may be simply modified in the future to accommodate other requirements and scenarios, such as 60Hz powerline interference.

Contact us
Find out more information

ASN filter designer home page and resources

www.advsolned.com/asn_filter_designer.html

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