Optimized Filter design for electric Big Trucks

Scalable: Bachelor/Master/Internship project

Summary:

Over the past several years, electric forklift trucks and container handlers have been designed by Hyster-Yale(both battery and Fuel cell powered). For the fuel cell powered container handler trucks, there are always DC/DCs used in conjunction with Fuel cells. This filter setup attenuates EMI noise generated by DC/DC that is used to boost fuel cell voltage to DC Link voltage and ensures no back current from DC link to Fuel cells.

Problem definition:

An important part of Electromagnetic Compatibility (EMC) research is the measurement and prediction of the electromagnetic interference (EMI) emission produced by an EUT, with the next step being a mitigation solution. Filtering is one option, which this assignment is all about.

Filter design needs optimization based on measurements on current generation of trucks. Optimization shall cover reviewing current specs of capacitors and ferrite cores and based on measurements if we can have lesser components, with improved reliability, and so on. Recommend new layout to reduce volume taken up by the filterbox.

Method:

The student will be performing EMI measurements [1] at the location of the company. Based on the meaurements of the EMI, and the already existing mitigation solution, a study will be peformed on optimization toward weight and volume reduction[2].

Research objectives:

Understand the EM environment, including noise- source, path and possible vicitims. Starting from a known solution, the objective it to optimize it with respect to volume, weight, reliability and perhaps even cost. It becomes a multidimensional optimization problem, with many aspects to be taken into account and traded-off.
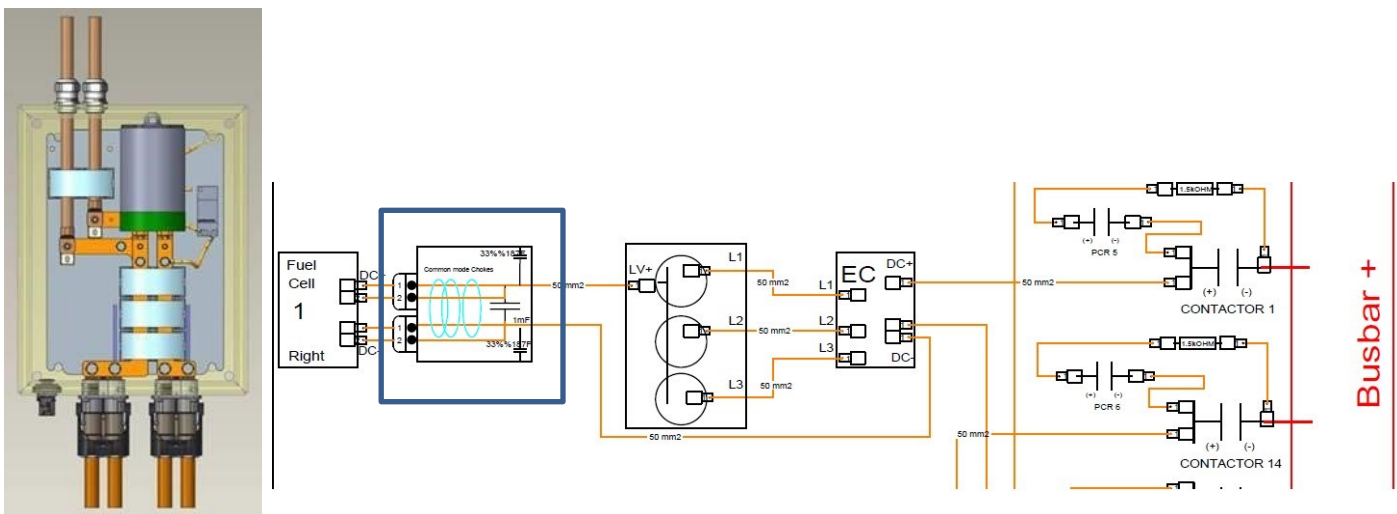
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Courses:

No specific courses are needed as a background. A good affinity with Matlab is very beneficial for doing this assignment, and your basic circuit analysis theory.

[1] D.Nemashkalo, L. Malburg, T. Hartman, N. Moonen, and F. Leferink, "Multichannel Time-Domain Measurements for EMI Filter Optimization in All-Electric Aircraft," Proc. 2022 ESA Work. Aerosp. EMC, no. 1, May. 2022.

[2] D. Nemashkalo, N. Moonen, and F. Leferink, "Practical Consideration on Power Line Filter Design and Implementation," Proc. 2020 EMC Europe, Rome 2020, Sept. 2020.

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