Modeling of electric power system in electric vehicles

NI Automotive Forum Sweden
7 November 2019
Per Widek
What does “the future” mean from an electrical layout?
What is Common mode and differential mode?

What is the effect from the motor drive in the other components?

How shall the requirements be written towards suppliers to get a good system design?
Common mode currents and voltages
The model of the system described earlier has partly been built.

The system is “stiff” is hard to solve. More challenges 😊

First results this week shows good correlation with simulations and measurements.
Measurement vs. simulation

SEC presentation CM current at AUX
SEC presentation Pole Chassi voltage at AUX
SEC presentation Pole Chassi voltage at AUX

SEC presentation CM current at Motor Drive
SEC presentation Pole Chassi voltage at Motor Drive
SEC presentation Pole Chassi voltage at Motor Drive

VOLVO GTT / LTH IEA, Per Widek,
7 2019-10-28
Vehicle to measure on - Bus

- Bus is 24 m long
- Some equipment is on the roof
- Some equipment in the engine compartment
Devices under test are distributed in the vehicle

The system reflects a vehicle but is not exactly the same
System
System and measurement boxes
Requirements on the new measurement system

• Synchronized measurements in the complete system
• Distance from sensor to oscilloscope is up to 10m.
• Be able to log and synchronize voltage, current and CAN signals. (CAN low sample rate)
• Must store more than 10 minutes of measurements
• Range as follows:
  – Current measurement 0-750A
  – Voltage measurement 0-1000V
  – Calculate the phase for U vs. I
  – Frequencies from DC to 30 MHz
• Support functionality as FFT, export of data, ….
Measurement system

- A split “oscilloscope” system from NI with nx24 channels can solve the requirements for frequency range and storing data.
- Differential voltage probes
- DC and AC current probes
Requirements can be fulfilled for sensors

- I have not found any differential voltage probes with 10m long cables. Test has been performed at Volvo and Rise with extension coaxial cable and it works.

- For current sensors, Rogowski coils will be used. The supplier states that it works with extension coaxial cable when correction for cable delay is made.
Thank you!