

## TRAINING BROCHURE

# EMC in Power Electronic Systems training



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## EMC in Power Electronic Systems

**Price:** € 2,100 excl. VAT \*

**Duration:** 3 consecutive days

**Contact:** [training@hightechinstitute.nl](mailto:training@hightechinstitute.nl), +31 85 401 3600

**Score:** 8.3 ★★★★★☆

### Intro

A 3-days EMC course for engineers who are confronted with low frequent disturbances (from DC to approx. 150 kHz) caused by motion- and power conversion systems. These typical EMC-alike phenomena are not fully covered by international standards and regulations. The disturbances and their consequences will be discussed and analyzed. Solutions are based on a high level of 'good engineering practices'.

Low frequent disturbances are generated by:

- the mains frequency related current and voltages and their harmonics, power factor corrections, mains-filter applications and leakage current flowing everywhere: Protective Earth (PE) and mechanical structures, caused by the filtering to and from the mains;
- linear and rotation motion frequencies and their accompanying fluxes of motors (generally DC ... < 6000 rpm);
- pulse width modulation (PWM) c.q. the switching with power conversion, Photo Voltaic applications, LED drivers, etc.;
- utility and internet via the mains: power line communication (PLC), "Toon-frequent" (TF) / "Centrale Afstand Besturing" (CAB) / Ripple Control (RC).

The new course title EMC in Power Electronic Systems was chosen to better represent the training content

*This training is available for open enrollment as well as for in-company sessions. For in-company sessions, this Electromagnetic compatibility training can be adapted to your situation and special needs.*

### Objective

After the course, the participant knows:

- how to choose a proper cable, filter, grounding and shielding;
- how to use LTSpice to analyze a system consisting of a (motor) drive, filter, cable, actuator as a system

and will be able to:

- analyze, identify, quantify and document low frequent EMC problems;
- solve many of these problems;
- inform suppliers of various products / system parts about low frequent EMC problems with these products and give them clues that can help the suppliers to develop structural solutions for these problems;
- understand, assess and specify EMC parameters of (sub) systems, make this SMART.



### Certification

Participants will receive a High Tech Institute course certificate if results of group assignments and other training activities are sufficient.

### Trainers

[Mart Coenen BSc](#)  
[Dr. Ramiro Serra](#)  
[Dr. Mark van Helvoort](#)  
[Ernest Bron MSc](#)

*\* Prices are subject to change. Price correction will be applied at the end of the year.*

Keep me posted



## Target audience

This course is intended for engineers, designers, architects, project leaders and quality engineers working on the definition, development and qualification of motion systems from a few mW to MW for i.e. small robotic systems up to container transportation as well as areas of wireless power transfer, robotization and automated manufacturing.

Education: At least BSc in Electronics / Electrical Engineering / Physics / Mechatronics / Automotive.

Prior knowledge: Basics of Electricity, notion of Fourier (time – frequency domain), graphical presentation (bode diagram with amplitude / phase)

No prior knowledge / experience on EMC is required but familiarity with low frequent disturbances is beneficial.

This course is also important for mechanic engineers since their work has a big impact on the creation and transport of the resulting disturbance currents and they may have problems to understand certain concepts from the physical and electrical domain.

## Program

- Source – Victim model, EMC standards and requirements;
- EMC Phenomena
- Signal basics: Asymmetric and differential signals, single and 3-phase mains; Spectrum, time-frequency conversion;
- Basics electromagnetic fields. Maxwell versus Kirchhoff. Basics network theory about cables and filters, transfer impedance, common/ differential mode. Path of least impedance;
- Grounding;
- Conduction / Crosstalk (by common and near field coupling);
- Transmission lines. Cables basics, characterization, selection based on electrical properties, conduit shielding;
- Introduction to LTSpice: Circuit simulation;
- Filtering and compensation of PWM applications. Common - Differential mode, asymmetrical disturbances, leakage, high frequency connection, compensation dependent on environment (industry, medical), switching power transfer applications. Parasitics;
- System integration, specification of (sub) systems; linear versus PWM amplification; sensors, mutual interaction (ground loops and near-field coupling).
- Corrective measures and compensations are dependent on the environment (industry, medical);
- EMC Trolley, medical and motor application, lessons learned (10 golden rules).

Various measurement techniques will be shown to qualify and quantify the disturbances by demonstrations / simulations. The effect of the measures will be used to provide insight as to show the effect of the introduced measures.


## Methods

Lectures supported by practical demonstrations and hands-on sessions and exercises / quizzes. Course notes. Course book.

## Frequency

Once per year

Read the interview:

A portrait of Mart Coenen, a middle-aged man with short brown hair, a grey beard, and glasses, wearing a light blue striped shirt. He is smiling slightly and looking towards the camera. The background is dark and out of focus.

Interview with trainer Mart Coenen

*"EMC knowledge overcomes problems in motion systems."*

Remarks from participants:

- 'Most important items I've learned: theory, practical guidelines, trouble debugging.' > Lucas Koorneef - MI Partners
- 'Most important items I've learned: grounding & shielding aspects at 'motion control' frequencies . Shielding material characteristics and effect on EMC.' > Wiebe Albarda - MI Partners
- 'Very good training. Real good expertise from trainers.' > Bjorn van Olmen - Bosch Rexroth