

Electromagnetic modeling for solving EM-problems relevant to Industry and Society

A. Peter M. Zwamborn
TNO Physics and Electronics Laboratory
Oude Waalsdorperweg 63
P.O. Box 96864
2509 JG The Hague, The Netherlands
Email: zwamborn@fel.tno.nl

Abstract

Electromagnetic fields are an important asset in our current society. The electromagnetic spectrum is widely used to transport information from a source to a receiver. During the last decade, the number of users of electromagnetic spectrum has tremendously increased and as a consequence the number of (unintended) interference between systems is of growing concern. Also, especially caused by the increase of telecommunication applications such as mobile phones, the presence of EM-fields gives rise to concerns about possible health risks.

Besides intentionally generated electromagnetic field, the increase of electronic devices and systems also leads to unintentionally generated electromagnetic fields. These unintentionally generated fields might interfere with a user of that part of the spectrum. In order to manage the above-mentioned problems, engineers apply EMC-standards, frequency allocation management and non-ionizing radiation hazard standards.

The presentation will consist of a short introduction to the electromagnetic spectrum and the nature of the common electromagnetic sources. Subsequently, the importance of electromagnetic compatibility (EMC), electromagnetic interference (EMI) and electromagnetic field exposure levels (EMF) will be discussed. Relevant to both industry and society is to obtain (sub)-system designs that have an optimal (generally with respect to costs) level of EMC and EMI within, if applicable, the pertaining EMF-standards. In order to obtain such a system-design, advanced electromagnetic tooling is necessary. During the presentation, a couple of examples on system design and EMF-computations will be presented and discussed. These examples consists of Electromagnetic Engineering of the HF-antenna arrangement onboard a ship and near-field interaction between a hand-held transceiver and a human head. Also, the limitations of the computational methods used will be elucidated.

Finally, the need for future developments on advanced electromagnetic modeling in order to comply with Industrial relevance and developments in our society will be discussed.