This course covers EMC design considerations in the built environment, including requirements of standards (e.g. new EMC requirements of IET Wiring Regulations) and best practices, taking into account EMI issues and EMF health concerns.

EMC Design in the Built Environment

by

Er. Dr. Lock Kai Sang
BSc PhD FAAET FIES FIEC FSI Arb MIEM CEng ACPE PEng

Principal, PQR Consultants


16 - 17 July 2012
Hotel Royal Kuala Lumpur
8.30 am - 5.30 pm

23 - 24 July 2012
York Hotel Singapore

Who Should Attend

- Professional engineers
- Licensed electrical workers
- E & M design engineers
- Project engineers & coordinators
- Electrical contractors
- Facility engineers & technical specialists
- Project managers for build environment
- Teachers at tertiary institutions

Course Objectives

Electromagnetic compatibility (EMC) is now an important design consideration for the built environment. EMC compliance, to ensure functional safety and to prevent EMI induced mal-operation, is now a standard requirement for projects involving mission-critical electrical and electronic systems, such as MRT/LRT systems, hospitals, R&D laboratories, defence and telecommunication facilities. Electromagnetic disturbances should be properly addressed to avoid problems with safety, reliability and possible physical damage to electrical and electronic equipment.

Health hazard from long-term exposure to EMF is becoming a concern for electrical designers. EMC legislations such as the EMC Directive 2004/108/EC are compelling greater EMC consideration and emphasis in the built environment, including commercial buildings. Residences and workplaces should be located sufficiently far from high voltage apparatus or LV cables that carry large currents in order to avoid exposure to unacceptable level of electric or magnetic field.

A holistic approach for EMC planning, management, design and implementation should be adopted to solve the EMI threats to sensitive electronic equipment as well as addressing concerns of EMF health hazards. EMC requirements impact on overall building and structural design and thus should be addressed at the early stage of a building project.

Course Outline

- Basics of Electromagnetic Fields & Compatibility
  - Electromagnetic field revisited
  - EMC phenomenon in the built environment
  - Understanding EMC phenomenon
  - Susceptibility / immunity of electronic equipment
  - Requirements of EMC compliance
  - Performance and functional safety
  - Directives and Standards

- Health Hazards of Electromagnetic Fields
  - Effects of electromagnetic fields on human beings
  - Hazard level of electric field
  - Hazard level of magnetic field
  - Standards and guidelines on exposure limits
  - What some of the published reports say

- Sources of EMF and Interaction Mechanism
  - Origin of emitted EMF: natural and man-made sources
  - Low-frequency and high-frequency interference
  - Magnetic field and electric field
  - Near field and far field
  - EMC requirements near high current/high voltage installations
  - Conducted EMI
  - Common-mode impedance coupling
  - Inductive coupling
  - Capacitive coupling
  - Radiated coupling

- Earthing and Bonding for Noise Control
  - The misconception of “clean” earth
  - Single-point or multi-point grounding?
  - Signal reference grid/structure
  - Ground plane & ground window
  - Interconnection of earth electrodes
  - Coordinated SPD protection

- Shielding
  - Function of an electromagnetic shield
  - Basic shielding theory
  - Shielding effectiveness, absorption loss, reflection loss
  - Selection of shielding materials
  - Shielding with magnetic materials
  - Shielding discontinuity effects: apertures, penetration holes and seams
  - Shield racks, chassis, enclosures, cabinets, rooms

- Control of ELF Magnetic Fields
  - Separation and space arrangement
  - Minimize cable loop
  - Application of busbar system
  - Routing and cable configuration
  - Phase splitting
  - Power panel design
  - Shielding of ELF magnetic field
  - Active ELF magnetic field cancellation

- Protection of Electrical and Electronic Systems Against LEMP
  - Nature of lightning electromagnetic impulses (LEMP)

- Cabling
  - Emission of fields from cables
  - Source of cable interference
  - Segregation of disturbing and sensitive cables
  - Magnetic field produced by power cables
  - Cable configuration to minimize magnetic field
  - Recommended wiring rules

- Earthing Wiring Circuits, Cable Shields, Sheath and/or Armour
  - System interface problems
  - Fundamentals of cable shielding
  - Shielding terminations
  - Pitfalls to avoid in cabling
  - To earth or not to earth cable sheaths
  - Ground loop
  - Earthing consideration in signal interface
  - Earthing of power cable sheath and/or armour
  - Running cables close to ground plane

- EMC Requirements in Standards and Codes
  - Requirements in BS and IEC standards for electrical installations
  - BS 7671 (IET Wiring Regulations 17th Edition), Section 444
  - Sources of EM disturbances
  - Measures to reduce EMI
  - TN, TT Systems
  - Earthing and equipotential bonding
  - Interconnection of earth electrodes
  - Information technology installations

- Management of System EMC
  - The EMC Management Plan
  - Identifying EMC issues
  - EMC hazard analysis
  - Standards and codes
  - EMC management team
  - System EMC requirements
  - Design, engineering EMC guidelines
  - Procurement EMC requirements
  - Pre-installation electromagnetic environment survey
  - EMC test plan, commissioning, post-installation EMC measurement

- EMF Measurement
  - Low frequency EMF measurement
  - High frequency EMC measurement
  - Conducting EMC survey
  - Demonstration of EMF measurement

- Review and Case Studies
  - EMC considerations in data centre design
  - LTA/MRT EMC requirements
  - Shielding requirements of building electrical installations

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About the Instructor

Er. Dr. Lock Kai Sang

Dr Lock Kai Sang is well-received as a short course instructor. Participants appreciate his delivery based on a unique blend of hands-on professional and academic experience, including 15 years as practicing professional engineer and 17 years as university lecturer. He has conducted public and in-house courses and workshops in over 10 countries, including in-house training for several power utility companies in the region.

He is the Principal of PQR Consultants, a specialist consulting firm that provides professional engineering services in EMC and power quality solution, harmonic investigation and mitigations, lightning and surge protection. He has helped to solve many EMC problems in industry, particularly shielding of ELF magnetic field in the built environment. His team conducted EMC measurements for the Dubai-Metro projects. He is well-sought for troubleshooting challenging power problems, including data centres, hospitals, airport, wafer plants, rail transport systems, telecom facilities, petrochemical plants, tallest buildings in the region and MW drives on offshore platforms.

He obtained his B.Sc. (1st Class Honours) in Electrical and Electronic Engineering in 1975 from the University of Strathclyde, UK. He completed his Ph.D. in Electrical Engineering at the same university in 1979. He joined the National University of Singapore in 1980 and was the Head of its Power and Machine Division, Department of Electrical Engineering when he left to set up his consulting practice in 1997.

He is very well-versed with national and international codes and standards. He was Chairman of Singapore Standards Council for 6 years, actively contributing to the promotion and establishment of standards and codes of practice. He served 9 years as a member of the Electrical Industry Practice Committee.

He is a Past President of the Institute of Engineers, Singapore, Board Member of Professional Engineers Board Singapore, a Past Chairman of IEE, Singapore Centre and founding Chairman of IEEE Power Chapter, Singapore. He has a keen interest in energy efficiency issues and is presently Chairman of Accreditation Committee for Energy Service Companies (ESCOs). He is a co-author of “Grounds for Grounding – A Circuit-to-System Handbook” published by IEEE/Wiley.

Other courses to be conducted by Dr Lock in 2012

- Protection of Industrial Power Systems (August)
- Electrical Safety - Causes and Prevention of Electrical Hazards (September)
- Electrical Installations Design (October)
- Lightning Protections Buildings, Services and Electronic Systems (November)
- Technical Report Writing (December)

Registration Details

How to Register

TEL : (02) 64696615       FAX : (02) 64695190
Email : eem@pacific.net.sg

Fee & Payment : S’pore  M’sia
Individual Fee     S$1,098   RM 1,990
Group for 3 or more delegates    S$   998    RM 1,790
Fee includes tuition, training materials, lunch, morning/afternoon refreshments and certificate of completion.

For Singapore Course : Please made payment in S$ to “EEM Advancement Centre Pte Ltd”
For Malaysia Course : Please made payment in RM to “CPD Advancement Centre”.

Mail complete registration with appropriate payment to:
EEM Advancement Centre Pte Ltd, 170 Upper Bukit Timah Road, #18-01 Bukit Timah Shopping Centre, Singapore 588179.

Cancellation & Refunds : You may cancel your registration up to two weeks before the course and your registration fee will be refunded in full. If you need to cancel less than two weeks prior to the course, you (1) may send a substitute, (2) will be liable for 10% of the fee. Confirmed registrants who fail to attend and do not cancel their registrations in advance are liable for the entire fee.

The organizer reserves the right to cancel or reschedule the courses without prior notice.

Registration Form

EMC Design in the Built Environment
❑ 16 - 17 July 2012 @ Hotel Royal Kuala Lumpur
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Company ___________ Nature of Business ___________
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