

## One-day Conference on **Power Supply, EMC and Signalling, in Railway Systems**

**Date:** 18 March 2017 (Saturday)  
**Time:** 9:00 – 17:00 (8:30 for registration)  
**Venue:** Room V322, Jockey Club Innovation Tower, PolyU

This Conference is jointly organized by the Electrical Engineering Alumni Association (EEAA) of PolyU, the IEEE PES/IAS/PELS/IES Joint Chapter (HK), and the Electrical Engineering Department (EE) of PolyU, to celebrate the 80 Anniversary of Hong Kong Polytechnic University (PolyU).

With support from the Alumni Association Development Office (AAD) and Federation of Hong Kong Polytechnic University Alumni Associations (FHKPUAA) of PolyU, the Conference is also co-organized by:

HKIE Electrical Division,  
 IEEE EMC Chapter,  
 IET Railway & Transportation Section,  
 HKIE Control, Automation & Instrumentation Division,  
 Institute of Measurement and Control (HK), and  
 Asian Centre for Sustainable Development.

The Conference aims to focus on 3 main areas of railway systems, Power Supply, Electromagnetic Compatibility (EMC) and Signaling, all associated with electrical engineering. The six speakers have vast experience in the field of railway systems.

### Conference Agenda

08:30-09:00	Registration	
09:00-09:15	Welcome Message	Mr. William Chan, Chair, EEAA
09:15-09:30	Opening Address	Dr. Edward Lo, Associate Head, EE
09:30-10:30	Features of Different Railway Systems prevailed in Hong Kong	Mr. Perry Chow, EEAA
10:30-10:45	Tea Break	
10:45-11:45	Tackling Power Quality problems in Railway Systems	Dr. CT Tse, IEEE Joint Chapter
11:45-12:30	Electromagnetic Compatibility and Power Electronics for Railway Systems	Prof. Eric Cheng, EE
12:30-14:00	Lunch	
14:00-14:45	EMC Management and Related Technical Aspects in Railway Systems	Dr. Peter Leung, CityU (HK), EMC Consortium Limited
14:45-15:30	Signalling Principles	Dr. Mark Ho, MTR Academy
15:30-14:45	Tea Break	
15:45-16:30	Railway Signalling in Practice	Ir CS Chang, Key Direction Limited
16:30-16:50	Q & A	
16:50-17:00	Closing Remarks	Dr. Zhou Xu, Chair, IEEE Joint Chapter

## **Talk Synopses and Speakers:**

### **Talk 1: Features of Different Railway Systems prevailed in Hong Kong**

by Mr. Perry Chow, MTR Corporation Limited, and Committee member of EEAA

#### Synopsis

Public transportation in Hong Kong nowadays mainly relies on two rail networks: the Metro Railway network (1.5kV dc) and the High-Speed Railway (25kV 1-ph ac), both operated by the MTR Corporation Limited (MTRC). In addition, the Light Rail network (LRT, 750Vdc) in Tuen Mun and the Automated People Mover (APM, 600V 3-ph ac) in airport are also operated by MTRC. These 4 railway systems, featuring to serve different transportation and geographical requirements, require 4 different types of power supply.

Beginning with the railway systems of steam engine trains introduced to HK in 1910, the present talk will then review the railway development after electrification commenced in 1979. Salient features of different supplies to meet the different requirements will be described.

#### Biography



Mr. Chow obtained his Master degree in Electrical Engineering (EE), majoring in Railway Specialism from the University of Hong Kong Polytechnic University (PolyU). Awarded with CEng of The Institution of Engineering and Technology (IET) from United Kingdom Engineering Council, he is the committee for Railway Transportation Section of IET (HK). He had been appointed as the Mentor for students of EE Department of PolyU and the Honorary Secretary for Electrical & Mechanical Service Department Apprentice Association. He is also awarded the China Enterprise Trainer from China Government, and Grade C & H in Certificate of Registration of Electrical Worker from Hong Kong Government. Mr.

Chow is now working for the design of Overhead Line System of MTR Corporation (MTRC). Being a professional railway system engineer with over 30 years of Hong Kong project and maintenance training experience, he was responsible for providing courses for employees of Overhead Line & High Voltage sections and Technical apprenticeship in MTRC. The courses included the high voltage power distribution system and power protection system, the overhead line system and pump control circuit of the MTRC and power supply to Auto People Mover of Hong Kong Airport. Mr. Chow is also a part-time Lecturer for the railway power system courses offered by IVE and EEUNION.

### **Talk 2: Tackling Power Quality Problems in Railway Systems**

by Dr. CT Tse, IEEE PES/IAS/PELS/IES Joint Chapter (HK)

#### Synopsis

There are 4 main supply systems in Hong Kong railways: 25kV ac (KCR), 1.5kV dc (MTR), 750V dc (LRT) and 600V ac (APM, automatic passenger mover in airport), and each system exhibits different power quality (PQ) problems with respect to train characteristics. For instance, to tackle harmonics, East Rail Line of KCR has installed passive filter (but West Rail Line cannot) and APM with active filter, whilst the DC harmonics in MTR and LRT are very minor. In terms of imbalance, only the single phase of KCR has such, and pragmatic methods to suppress imbalance (current, not voltage) have been implemented since its electrification in 1982. The present talk will focus on PQ issues of harmonics and imbalance, whilst others such as voltage dip, voltage flickering, longitudinal induced emf, rise of earth potential (ROEP), dc earth current of MTR train injected to ac system of KCR... will be slightly covered. (Note: KCR, MTR and LRT systems are with MTRC.)

## Biography



**Dr. Tse** received his Higher Diploma from Poly, MSc from University of Manchester Institute and Science Technology (UK), and PhD degree from the University of Hong Kong. He was the Associate Professor with EE Department of PolyU before his retirement, and his main research is on power system stability and PSS design. Before he joined Poly in 1990, he was the Planning Engineer in CLP System Planning Dept. His major achievement was the analysis of, and providing solution to, the severe system oscillations in the interconnected systems of HK and South China in

early 80s. His CLP responsibility also included monitoring the PQ problems, particularly in local traction systems. In PolyU, Dr Tse had delivered different course lectures (both BEng and MSc) on railway traction power supply, and received several consultancies (both local and overseas, and short course) on traction harmonics, ROEP, induced emf, effect of dc traction current injection to ac traction systems, and protection design etc. His paper on ‘Impact of Unbalance Traction Load Single-phase Traction Load to Three-phase Power System’ was awarded the HKIE Best Transaction Paper Prize 2012. He also won the IEEE PES Chapter Outstanding Engineer Award 2012, due to his ‘Contribution to the theory and practice for power system stability, design of power system stabilizers, and the nurturing of high quality power engineers and researchers’.

## **Talk 3: Electromagnetic Compatibility and Power Electronics for Railway Systems**

by Prof. Eric K.W. Cheng, Department of Electrical Engineering, PolyU

### Synopsis

Electromagnetic Interference (EMI) is an important research area in railway traction environment. Since more than 30 years when the traction has been using power electronics drive and power converters, the high frequency switching injects serious electromagnetic radiation and conductive interferences. This imposes concerns on the signalling system. With the co-existence of the AC and DC electrification power system, the interference between the harmonics and the associated electromagnetic field will also have a significant effect on the safety.

The multiple issues such as isolation, earthing, mobile communication and also pantograph arcing are interesting topics of study. The talk will discuss various issues and the possible solution.

## Biography



**Prof Cheng** obtained his BSc and PhD degrees both from the University of Bath in 1987 and 1990 respectively. Before he joined the Hong Kong Polytechnic University in 1997, he was with Lucas Aerospace, United Kingdom, as a Principal Engineer and led a number of power electronics projects.

He received numerous awards related to electrical engineering, energy, magnetic materials and vehicle system. He has published over 300 papers and 7 books. He has conducted numerous projects related to railway systems and he is especially interested in electromagnetic compatibility. He developed the EMC laboratory of the university since 2000. He is now the professor and director of Power Electronics Research Centre of the University. His research interests are all aspects of Power electronics, Power Quality, Renewable energy, Motor drives, Energy Saving, Magnetic shielding, Magnetic coupling, Electric vehicle and Automotive advanced components.

## **Talk 4: EMC Management and Related Technical Aspects in Railway Systems**

by Dr. Peter Leung, Electronic Engineering Department of City University

### Synopsis

This technical talk gives an introduction to the EMC assurance process for the whole railway system to be functioned satisfactorily in its electromagnetic environment, and without introducing of any intolerable electromagnetic disturbances to other equipment or systems in that environment.

EMC Tests as required in equipment level will be presented; system integration on how the basic Lab test information is correlated to various EMC issues arises in equipment, sub-system and system level is also discussed. Examples of some EMC issues on Design guidelines, for Electrical Installations will be highlighted.

### Biography



**Dr. Leung's** research interests have been in Electromagnetic Compatibility (EMC), including Human safety on human exposure, EMC in Fixed Installations, EMC Management, and EMC in Railway Systems. Dr. Leung is actively involved in numerous EMC railway consultancy projects assisting industry, in both Hong Kong and overseas including Doha Metro, MTRC, Miami APM, Singapore, and Brazil SPL6 Metro recently.

He acted as Director of Electromagnetic Compatibility (EMC) Consulting Group of CityU Professional Services Ltd, City University of Hong Kong; he is also a Non-executive Director of EMC Consortium Limited, Hong Kong.

Dr. Leung is currently an Associate Professor in the Electronic Engineering Department of City University of Hong Kong; he teaches MSc Post-graduate course in EMC -Theory, Design and Measurement. He is also the founding Chairman of EMC Hong Kong Chapter, of IEEE, Hong Kong Section.

## **Talk 5: Signalling Principles**

by Dr. Mark Ho, MTR Academy

### Synopsis

The technical talk aims to provide a basic understanding of railway signalling principles and equip the audiences with a general background for the subsequent talk on signalling systems and implementation.

The fundamental proposes of the railway signalling are first defined, followed by discussions on their implications for development and formulation of signalling principles. This talk will highlight the history and evolution of railway signalling in response to the growing traffic demand, and thus the underlying principles of various means of train detection and communication of information to individual trains, supplemented with the key technical terminologies.

## Biography



**Dr. Ho** obtained his BEng and PhD degrees in Electronic and Electrical Engineering at the University of Birmingham, UK. He then started his academic career at the Department of Electrical Engineering, Hong Kong Polytechnic University. His teaching covers railway-related subjects over various levels and his research interests include signalling and traffic control, condition monitoring, rail open market and AI applications. He was an Associate Professor when he left PolyU.

Mark then joined the Queensland University of Technology of Australia, leading the development and management of postgraduate courses at the Faculty of Built Environment and Engineering, before moving to the University of Wollongong to lead the rail research at the SMART Infrastructure Facility. Mark is now the Deputy Dean of the MTR Academy, overseeing the academic programmes.

Mark is a Fellow of Engineers Australia, a member of IET and a Chartered Engineer. He is also a Honorary Professor at the School of Traffic and Transportation Management of the Beijing Jiaotong University.

## **Talk 6: Railway Signalling in Practice**

by Ir CS Chang, Key Direction Limited

### Synopsis

This technical talk gives an introduction to the Signalling systems in practice. The concept of Automatic Train Protection to ensure safe operation particularly for high speed and high frequency train services shall be discussed. It will cover the different type of signaling systems being adopted for various railway operations in the world including fixed block signalling, moving block signalling, distance-to-go system and the modern communication based train control (CBTC) system.

Towards the end, the concept of the standards for ETCS (European Train Control System) and CTCS (Chinese Train Control System) shall be highlighted to the audience and the signalling systems being used for various high speed rail operations in the world shall also be discussed.

## Biography



**Ir CS Chang** obtained his BSc degree in Electrical Engineering majoring in computer software from the University of Hong Kong and an MBA degree from Chinese University of Hong Kong.

CS is a professional railway system engineer with over 30 years of international project experience. CS possesses a wealth of knowledge and experience in the design, installation, testing and commissioning of multi-disciplinary and sophisticated railway systems as well as in the project management of mega size railway projects.

He has been working as a project manager on various multi-disciplinary control, communication and signalling projects for Mass Transit Railway Corporation and Kowloon Canton Railway Corporation. He is now operating railway consultancy firms of Key Direction Limited as the Chairman and Director and Pypun-KD & Associates Limited as Chief Executive Officer with current projects covering various major cities in the world. He is also the CEO for the training company, KCG Corporation Limited, which is organizing training courses in HK, Malaysia and Singapore.

CS is also a Part-Time Lecturer for the MSc course on Railway Engineering in the Chinese University of Hong Kong and the Adjunct Lecturer in Singapore Polytechnic. In addition, CS has written and presented over 30 papers in various international conferences on project management, system engineering, system interface management and system integration for railway.

## Who Should Attend?

This Workshop is designed for:

- ✓ Railway System Researchers
- ✓ Plant Engineers
- ✓ Environmental Engineers
- ✓ High Voltage Engineers
- ✓ Control and Instrumentation Engineers
- ✓ Consultants/Contractors
- ✓ Transportation/Logistics Staff
- ✓ University and College Lecturers
- ✓ Railway Engineers
- ✓ Engineering students/graduates

## Registration:

This Conference is open to public and is free of charge. Please enroll online via <http://www.ieee-hk-2pipi.org/Activity-Next> before **10/3/2017**, and places are strictly limited to **280** on first-come-first-served basis. Attendance Certificate will be issued after the event.

As for lunch, 15 tables (i.e. 180 seats) have been booked at the Chinese restaurant, 4/F Communal Building. The charge is **\$80** per head (cash to be collected during lunch) and prior online enrollment is needed.

For enquiry, please contact Dr. C.T. Tse [eecttse@connect.polyu.hk](mailto:eecttse@connect.polyu.hk). For more details, please visit <http://www.ieee-hk-2pipi.org/Activity-Next>.

## Venue Location:

