The 3rd Workshop on Railway Operation for Safety and Reliability

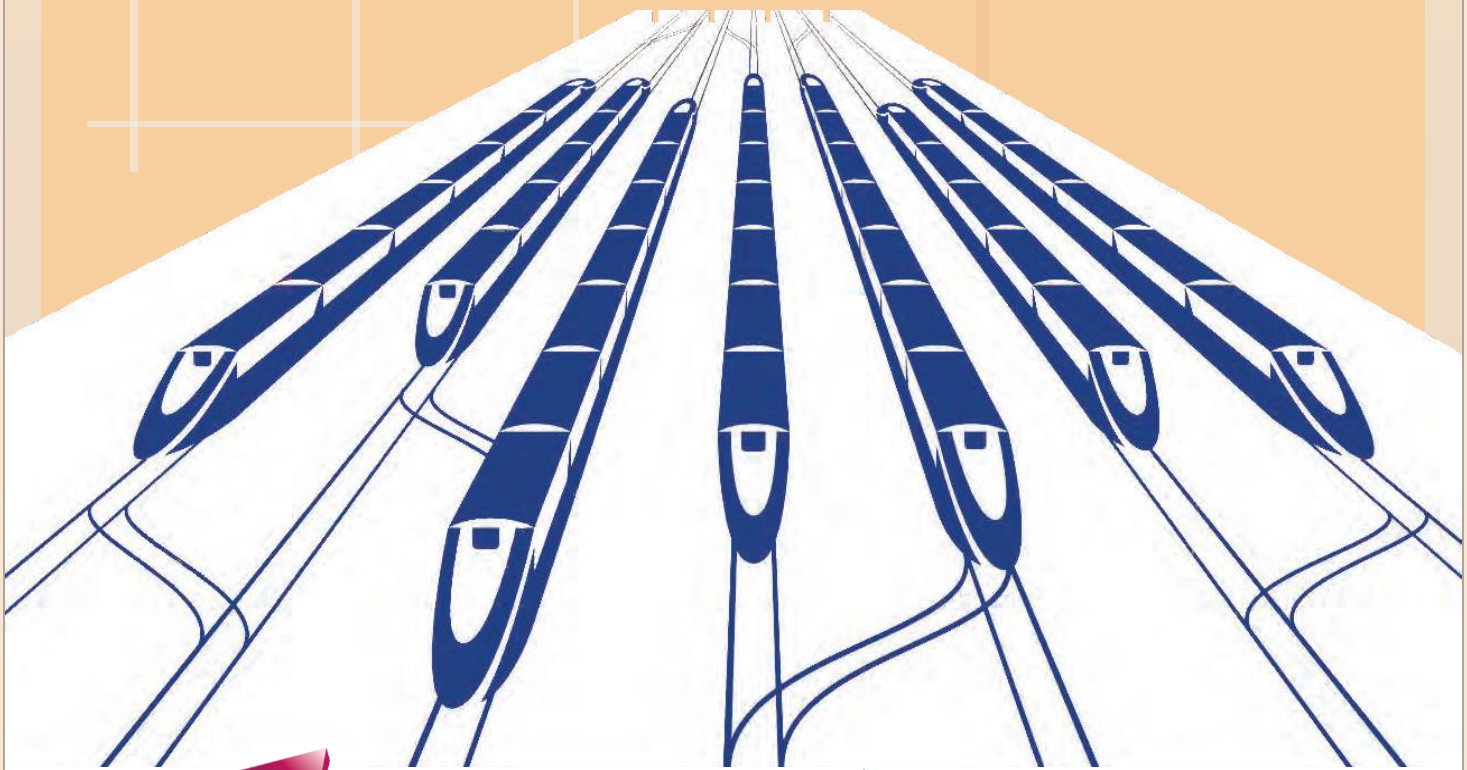
Date: 29th November, 2018

Time: 9:00 am – 6:00 pm

Venue: Connie Fan Multi-media Conference Room

Organized by:
School of Data Science, City University of Hong Kong

Supporting Organizations:
State Key Laboratory of Rail Traffic Control and Safety, Beijing Jiaotong University
Advanced Public Transportation Research Center, National Taiwan University
Department of Architecture and Civil Engineering, City University of Hong Kong



CityU 香港城市大學 City University of Hong Kong

北京交通大學 BEIJING JIAOTONG UNIVERSITY

國立臺灣大學 National Taiwan University

Speakers

Prof. Christopher P.L. Barkan	University of Illinois at Urbana-Champaign
Prof. Ingo A. Hansen	Delft University of Technology
Prof. Nalinaksh S. Vyas	Indian Institute of Technology Kanpur
Prof. Andy Chit C. Tan	Universiti Tunku Abdul Rahman (UTAR)
Prof. Norio Tomii	Chiba Institute of Technology
Prof. Shaomin Wu	University of Kent
Dr. Richard A. Dwight	University of Wollongong
Dr. Melody Khadem Sameni	Iran University of Science and Technology
Dr. Yu Qian	University of South Carolina
Dr. Tony Lee	MTR Corporation
Mr. Yasushi Ujita	Railway Technical Research Institute
Mr. Chau Fat Chan	Electrical & Mechanical Services Department

Organizing Committee

Co-chairs

Prof. Kwok L Tsui	City University of Hong Kong
Prof. SM Lo	City University of Hong Kong
Prof. Richard Yuen	City University of Hong Kong

Members

Prof. Tao Tang	Beijing Jiaotong University
Prof. Yong Qin	Beijing Jiaotong University
Prof. Jason SK Chang	National Taiwan University
Prof. Tsung-Chung Kao	University of Illinois at Urbana-Champaign
Prof. Min Xie	City University of Hong Kong
Dr. Peter Tse	City University of Hong Kong

Conference Schedule

08:45 – 09:00	*Registration*
09:00 – 09:15	**Welcome Speech** - Prof. Dingxuan Zhou, Dean of School of Data Science, City University of Hong Kong - Prof. Kwok L. Tsui, Project Coordinator and Chair Professor of School of Data Science, City University of Hong Kong

Risk and Reliability Management

Session Chair: Prof. Min Xie, City University of Hong Kong

09:15 – 09:45	**Railroad Safety and Risk Analysis Using U.S. Accident Database Systems** - Prof. Christopher P.L. Barkan, University of Illinois at Urbana-Champaign, US
09:45 – 10:15	**A Novel Approach to Modelling Time-between Failures of a Repairable System** - Prof. Shaomin Wu, University of Kent, UK
10:15 – 10:45	**Degradation Modelling and Maintenance Scheduling: Exploring the Role of Big-Data Analytics** - Dr. Richard A. Dwight, University of Wollongong, Australia
10:45 – 11:00	*Refreshment Break*

Railway Safety Monitoring and Operation

Session Chair: Dr. Peter Tse, City University of Hong Kong

11:00 – 11:30	**Acoustic Emission for Diagnosis of Train Rotating Systems** - Prof. Andy Chit C. Tan, Universiti Tunku Abdul Rahman, Malaysia
11:30 – 12:00	**Wheel-Flat Dynamics Modeling and the WILD (Wheel Impact Load Detection) System** - Prof. Nalinaksh S. Vyas, Indian Institute of Technology Kanpur, India
12:00 – 12:30	**Entering a High Speed Rail New Era** - Dr. Tony Lee, MTR Corporation, Hong Kong
12:30 – 14:00	*Complimentary Lunch at City Top Staff Lounge, 9/F Amenities Building*

Conference Schedule

Disruption, Efficiency, and Safety Management
Session Chair: Prof. Jason Chang, National Taiwan University

14:00 – 14:30	**Smart Disruption Management Through More Reliable Estimation of the Disruption Length Using a Copula Bayesian Network Method** - Prof. Ingo A. Hansen, Delft University of Technology, The Netherlands
14:30 – 15:00	**How to Plan and Manage Timetables with Skip-stop Operation Efficiently** - Prof. Norio Tomii, Chiba Institute of Technology, Japan
15:00 – 15:30	**Recent Research Activities by RTRI for High-speed and Commuter Rolling Stock** - Mr. Yasushi Ujita, Railway Technical Research Institute, Japan
15:30 – 16:00	*Refreshment Break*

Recent Development in Rail Operation Management
Session Chair: Prof. SM Lo, City University of Hong Kong

16:00 – 16:30	**Railroad Infrastructure 4.0: Development and Application of an Automatic Ballast Support Condition Assessment System** - Dr. Yu Qian, University of South Carolina, US
16:30 – 17:00	**"How to Measure and Compare Safety Performance of Railways"?** - Dr. Melody Khadem Sameni, Iran University of Science and Technology, Iran
17:00 – 17:30	**Innovative Approaches for High Speed Rail Safety of Hong Kong** - Mr. Chau Fat Chan, Electrical & Mechanical Services Department, Government of the Hong Kong Special Administrative Region, Hong Kong
17:30 – 17:35	**Closing Remarks**
18:00 – 20:00	*Conference Dinner at City Chinese Restaurant, 8/F Amenities Building (by invitation)*

Prof. Christopher P.L. Barken

Professor , Rail Transportation and Engineering Center, University of Illinois at Urbana-Champaign, US

Railroad Safety and Risk Analysis Using U.S. Accident Database Systems

Abstract. For more than four decades, the North American railroad industry and government agencies in the U.S. and Canada, have been developing extensive databases containing a variety of types of information pertinent to understanding and quantifying railway safety and risk. These databases include detailed information on causes and characteristics of accidents, type and extent of damage to rolling stock involved in accidents, casualties and dangerous goods released, design of rolling stock and vehicles, train operation and infrastructure characteristics, and rail traffic volume, types, and routing. Many of these databases are freely available via the internet or can be purchased at relatively modest cost. Certain others are proprietary but may be used under reasonable conditions of confidentiality in cooperation with the owning organization. Integration of these databases and use of analytic and optimization techniques enables robust evaluation of policy questions and investment decisions intended to reduce transportation risk. These analyses have been used to quantitatively evaluate the effectiveness of potential regulations, identify improved operating practices, optimize the safety of vehicles and infrastructure, and in general to inform risk management decisions related to policies, operations, and engineering design. Representative datasets will be introduced, and examples of how they have been used to address important railway safety questions in North America will be presented. The over-arching objective of these types of analyses is to provide tools to identify the most cost-effective approaches to maintain and improve safety.

About the speaker. Christopher Barkan is Professor and George Krambles Director of the Rail Transportation & Engineering Center at the University of Illinois at Urbana-Champaign. He is also the Director of the National University Rail Center, a consortium of universities focused on rail research and education funded by the US Department of Transportation. Chris received his Bachelors' degree from Goddard College, and his M.S. and Ph.D. from the State University of New York at Albany. Prior to coming to the University of Illinois, he was Director of Risk Engineering at the Association of American Railroads in Washington, DC where he was employed for 10 years. Chris moved to Illinois in 1998 to lead their railroad engineering academic and research programs. He teaches several courses on railway engineering and conducts research on rail safety and risk, rail capacity, and railroad infrastructure.

Prof. Shaomin Wu

Professor, Business Applied Statistics, University of Kent, UK

A Novel Approach to Modelling Time-between Failures of a Repairable System

Abstract. Maintaining a modern railway system needs an integrated approach, which includes maintenance methods from corrective maintenance to predictive maintenance. This presentation discusses a new failure process model for a repairable system.

The most commonly used models for the failure process of a repairable system have two drawbacks: (1) they assume that the system is composed of one component, and (2) they may contain too many unknown parameters that must be estimated from failure data. In the real world, however, most systems are multi-component systems and failure data are too sparse to obtain stable estimates for models with many parameters. This necessitates development of new models to overcome the drawbacks. To this end, this presentation proposes a new model and investigates its special case model, both of which model the failure process of a repairable multi-component system and contain a small number of unknown parameters. It then discusses a parameter estimation method and compares the performance of the proposed models with nine other models based on artificially generated data and fifteen real-world datasets. The results show that the two new models outperform the nine models.

About the speaker. Professor Shaomin Wu is a professor of business/applied statistics at Kent Business School, University of Kent. His current research interests include Business Data Analysis, Applied Stochastic Processes, and Risk Management.

Professor Wu serves on the editorial board of several journals, including IISE Transactions, Reliability Engineering and System Safety, and IMA Journal of Management Mathematics. He has co-chaired 4 international conferences, has been invited to act as scientific committee members by more than 20 international conferences, has edited 4 special issues. Professor Wu has also won research funding from the EPSRC as the PI and a Co-I, respectively. He is currently undertaking a research project funded by the ESRC as a co-investigator.

Dr. Richard A. Dwight

Associate Professor, Faculty of Engineering and Information Sciences, Centre for Engineering Mechanics, University of Wollongong, Australia

Degradation Modelling and Maintenance Scheduling: Exploring the Role of Big-data Analytics

Abstract. Use of big data analytics is considered to be a major contributor to the advancement of engineering asset management. This is of particular interest to rail organisations who are keen to improve their approach to various asset-related activities given the significance of asset performance and cost to their businesses.

The general contribution of big-data analytics has been examined within the context of the maintenance activities and their fundamental cost drivers. This has been applied to rail systems. The possible roles of big-data analytics will be explored in the context of condition-based maintenance; application of sensor-technologies to rolling stock; degradation modelling and flow-on effects to the scheduling of maintenance, particularly for rolling stock fleets. Promising areas for research in these areas will be proposed.

About the speaker. Dr. Richard Dwight is the Director of the Engineering Asset Management Research Group and Associate Professor at the School of Mechanical Materials Mechatronic and Biomedical Engineering at the University of Wollongong. He established and has directed the post graduate program in engineering asset management since 1992, and rolling stock engineering, since 2007. His academic career was preceded by 19 years in the steel industry in roles from investigation engineer to engineering manager. His research interest and publication record spans engineered asset decision support systems; engineering asset management system design; maintenance system simulation and modelling; organisational (specifically maintenance) performance measurement systems; safety analysis and safety systems; wheel-rail noise; and teaching and learning.

Prof. Andy Chit C. Tan

Professor, Lee Kong Chian Faculty of Engineering & Science, Universiti Tunku Abdul Rahman, Malaysia

Acoustic Emission for Diagnosis of Train Rotating Systems

Abstract. Recent advances in material technology and computing system have further advanced the application of acoustic emission (AE) techniques in numerous industrial fields. Among them are non-destructive testing in pipeline systems and pressure vessels, material characterizations, actuators in vibratory systems and diagnostics of rotating systems. Its excellent property has enabled it to be used as sensors in engineering applications for early stage detection of incipient defect. Although, it has high sensitivity for early fault detection with high signal to noise ratio, it also comes with many challenges. The microscopic material defamation generates high frequency stress waves, in terms of MHz. This has limit the widespread usage of the technique as it requires high frequency data transfer and storage for analysis. For low speed operations, with a high sampling rate to capture a full complete revolution it can end up with massive amount data.

This presentation illustrates a data processing technique to overcome the massive data acquisition involving Peak Hold Down Sampling (PHDS). Contrary to traditional down sampling, this technique preserved the peaks caused by period impacts for a defect in a bearing or gears. The inherent non-linear characteristics of AE sensors have made it impossible for direct comparison of a multi-source multi-sensor application, such as diagnosis of multi-cylinder diesel engine. This presentation describes a process of normalizing the AE sensor responses to enable direct comparison of the output signals detected by an array of sensors. This technique is demonstrated on a small diesel engine and a real-life industrial gearbox in mining industry.

It is concluded that the proposed PHDS has enable massive data reduction for on-line diagnostics. The normalization of AE sensor responses has enabled direct comparison of activities within the combustion process of a multi-cylinder diesel engine. The effectiveness of AE in detecting incipient faults is demonstrated in early detection of a bearing failure in mining green carbon processing gearbox where the vibration sensor failed to detect. It has great potential for early detection of incipient fault of rotating systems in high speed trains.

About the speaker. Professor Andy CC Tan received his BSc(Eng) and PhD degrees in Mechanical Engineering from the Westminster University, London. His research interests include noise and vibration, and sensor design for active noise and vibration control. He applied adaptive signal processing and blind deconvolution algorithms to enhance the desired signals corrupted by noise for the detection of incipient faults. These algorithms together with acoustic emission sensors were used in low speed machinery condition monitoring. He is currently leading the research on acoustic emission for pipeline leak detection and long range condition assessment of oil pipelines. In research, he has published over 300 research publications and research grants of over Aus$4M. He is Chairman of the Centre for Railway Infrastructure and Engineering at UTAR. With the new research centre, he has directed his research to diagnosis of rotating systems of high speed railway. He is a Chartered Professional Engineer and Fellow of the Institution of Engineers, Australia; International Society for Engineering Asset Management; and International Society of Acoustic Emission. His distinguished international awards include Australasia Engineering Education (AAEE) Award for outstanding contribution to engineering education and International Network for Engineering Education and Research (iNEER) Award for pioneering the twin degree programs, which has contributes to an alternate mode of education around the Asian regions and beyond.

Prof. Nalinaksh S. Vyas

Professor, Department of Mechanical Engineering, Indian Institute of Technology Kanpur, India

Wheel-Flat Dynamics Modeling and the WILD (Wheel Impact Load Detection) System

Abstract. Development of flats on the wheels of railway engines and wagons is one of the major causes of track and ride quality deterioration. Wheel flats are flat zones on the wheel tread caused by unintentional sliding of the wheel on the rail when the brakes lock. A fresh wheel-flat has the shape of a geometric chord on the wheel circumference. Forces from the wheels with flats can be up to four times higher than those from normal wheels. Wheel flats cause large dynamic forces on the rail. According to popular practices, flats on wheels should be restricted to a length of 60 mm and a depth of 0.9-1.4 mm. In this range the dynamic wheel load increases by approximately, 30 kN/mm for timber sleepers and 50 kN/mm for concrete sleepers. Wheel flats are also known to inflict very high acceleration levels (about 500g) on the track. These high vibrations get transmitted to the rolling stock, which induce forces much larger than permissible values and cause damage to the suspension system, frame and the body of the rolling stock. In this talk modeling of wheel-flat and rail interaction dynamics through a finite element procedure will be discussed. Typical wheel flat loading patterns and response will be illustrated for various cases of rigid and flexible rail supports and damping.

Subsequently technology developed for Wheel Impact Load Detection, including detection of Wheel Flats will be discussed. The equipment measures the impact load being exerted at the wheel rail interaction point in dynamic condition. The system based on dynamic impact load measurement principle is widely used on most of the advanced railways. This prototype was successfully installed on down line at Ajgain station near west cabin in Kanpur-Lucknow section of Northern Railway (a railway station, 38 kms away from Lucknow) and round the clock monitoring of the rolling stocks passes through the system was being done. The salient features of the WILD system are:

- Round the clock automatic recording of all rolling stocks passing through the instrumented rail.
- Report generation.
- Counts number of axles
- Measures Average Dynamic Impact Load & Maximum Dynamic Impact Load of all the wheels
- Calculates Impact Load Factor (ILF) for all wheels
- Calculates speed of each axle and the average speed of train
- Identifies overloaded wheel
- Identifies and count defective wheels as per specified ILF and Maximum dynamic Impact Load of the wheel and rates them according to the severity of defect
- Identifies and count number of Engines, Coaches / Wagons and Brake Vans.
- Relates each axle with engine or coach/wagon or brake van. Also it's position in the identified rolling stock
- Calculates average load for one wagon/coach of the train and identifies overloaded wagon / coach and also reports overloaded coach / wagon position from the front end of the train
- Can Transmit on-line run reports to TXR control/maintenance depot or any place specified for this purpose for further necessary action
- Checks and calibrate all channels periodically to maintain accuracy
- Self diagnoses the faulty channels and discard them during analysis

This equipment has already been commercialised and has been installed in more than a dozen locations, from where live data from running trains and the generated reports will be shown.

About the speaker. Prof. Nalinaksh S. Vyas has been at the Indian Institute of Technology Kanpur since 1987 and also currently functions the Chairman of the Technology Mission for Indian Railways of the Government of India. At IIT Kanpur, he been the Head of Mechanical Engineering Department, Nuclear Engineering Department, Centre for Mechatronics and the Innovation Laboratory. He has also been a Visiting Professor at Virginia Tech, USA; INSA Lyon, France; Lulea University Sweden and National Chung Cheng University, Taiwan. He served as the Vice Chancellor of Rajasthan Technical University between 2013---15. His research interests lie in Turbomachinery Dynamics, Nonlinear Parameter Estimation, Instrumentation and Integrated Health Monitoring of Machinery. He has executed major projects for organisations like the Aeronautical Research & Development Board, Department of Science & Technology, Indian Space Research Organisation, Ministry of Railways, TATA Consultancy Services, Larson & Toubro, Scooters India, Hindustan Aeronautics Limited, Gas Turbine Research Establishment, among others. He currently chairs the Technology Systems Development Program and the Expert Group on Smart Manufacturing --- Automation and Information & Communication Technologies (ICT); Advanced Robotics (AR) & Industrial Internet of Things (IIOT), of the Department of Science & Technology, Government of India. He is also a member of Advisory Group of Experts (AGE), NITI Aayog, on Upgradation of Technology and Leveraging 'Make in India' in the Railways. He has been the National Coordinator for an earlier Technology Mission on Railway Safety, Govt of India; Chairman, Automotive Parc, National Program on Smart Matls & Structures, Govt of India; Project Coordinator, Nano---Satellite, JUGNU Project with ISRO; Consortium Leader, Automotive Electronic Stability Program, Core Group on Automotive Research; Member, Expert Task Force on IVHM of LCA (Light Combat Aircraft); Editor, ISSS Journal (International Society of Smart Systems); Editor, Advances in Vibration Engineering; Member, Indo---US Task Force on Embedded Systems; Founding Director, International Society on Asset Management, Australia. He is, currently, also on the Board of Governors of IIT Jodhpur and on the Executive Council of the All India Council for Technical Education.

Dr. Tony Lee

Chief of Operations Engineering, MTR Corporation Limited, Hong Kong

Entering a High Speed Rail New Era

Abstract. With the opening of the High Speed Rail (Hong Kong Section) in September 2018, MTR opened a new chapter in Hong Kong's development. Running at 200km/h, the 26km railway runs from West Kowloon and connects Hong Kong with the Mainland's 25,000km national high-speed railway network.

The presentation will share the success story of MTR in entering the High Speed Rail New Era, with focus on railway engineering and system characteristics, maintenance standards, major challenges during line opening and on sustaining system performance with application of new technologies.

About the speaker. Ir Dr Lee Kar Yun is currently the chief of Operations Engineering responsible for directing all engineering services in enhancing asset worth to business and ensuring that whole life-cycle asset management and renewal meets safety, business and customer requirements. He has over 32 years of railway systems maintenance, design and engineering experience, and is also an active railway system researcher, particularly on using sensors to monitor performance of equipment. He is now the Co-investigator of the "Smart Railway Sensor Networks" research project run by the Hong Kong Polytechnic University, and holds several patents on fiber optic sensor inventions for railway applications. He is specialized in Foresight-Driven asset Management Systems & Operation Assurance, Smart Railway Development and Predictive & Prescriptive Maintenance using Big Data Analytics.

Prof. Ingo A. Hansen

Professor, Department of Transport and Planning, Delft University of Technology, The Netherlands

Smart Disruption Management Through More Reliable Estimation of the Disruption Length Using a Copula Bayesian Network Method

Abstract. The uncertainty in the lengths of railway disruptions is a major problem of disruption management. In practice, a series of predictions concerning the expected disruption length estimation is based on the expertise and judgment of traffic controllers and maintenance managers.

A Copula Bayesian Network method has been developed to construct a disruption length prediction model based on historic data of registered traffic incidents and logged maintenance jobs. The method considers the factors influencing the length of a disruption and models the dependence between them to produce a prediction. The disruption length is represented by a probability distribution from which random samples of disruption length are generated. When a disruption occurs, the model is conditioned on the realization of the influencing factors. The disruption length model assists the traffic control staff by updating the uncertainty of disruption length every time new information about the disruption is available. A user-friendly and computationally-efficient software called UNINET which implements the algorithm of the Copula Bayesian Network will be used. An illustrative example for the estimation of the disruption length of track circuits and switches based on real SAP data is presented.

About the speaker. Prof. Dr.-Ing. Ingo Hansen studied 1968-1974 Civil Engineering with mayor in Transportation at the Technical University of Hannover/Germany. He got his PhD in Transportation Modelling from the University of Hannover in 1978 and worked from 1977 to 1994 as transportation consultant for planning, design, construction and operation of railway and other public transport systems in Germany and abroad. He was full professor for Design of Transport Facilities in the Department of Transport and Planning of the Faculty of Civil Engineering and Geosciences at Delft University of Technology/Netherlands from 1994 to 2011. Since 2012 he is visiting professor at the School of Traffic and Transportation of Beijing Jiaotong University and the Chinese Academy of Railway Sciences.

He was President of the International Association of Railway Operations Research (IAROR) since its foundation in 2005 until 2015, since 2015 is Vice-President respectively and co-organized the bi-annual Conferences on Railway Operations Modelling and Analysis in Delft 2005, Hannover 2007, Zurich 2009, Rome 2011, Copenhagen 2013, Tokyo (2015), and Lille 2017. He is editor-in-chief of the Journal of Rail Transport Planning & Management (JRTPM), member of the Editorial Advisory Board of Transportation Research Part B and Ingenieria Ferroviaria, as well as frequent guest reviewer of a number of transportation journals as Transportation Research Part C, IEEE Transactions on ITS and Journal of Advanced Transportation. He co-edited the books Railway Timetable and Traffic (2008) and Railway Timetabling and Operations (2014) and (co-)authored more than 100 publications.

Prof. Norio Tomii

Professor, Department of Computer Science, Chiba Institute of Technology, Japan

How to Plan and Manage Timetables with Skip-stop Operation Efficiently

Abstract. Timetables with skip stop patterns, especially ones with coupling of rapid trains and regular trains are very popular in Japan and work very well. On the other hand, such timetables are seldom found in other countries. One reason is that we need to settle various kinds of problems which occur related with coupling of rapid trains and regular trains. In this presentation, ideas to effectively realize such timetables are explained.

About the speaker. Professor TOMII graduated from the graduate school of Kyoto University majoring in computer science. Then, he started his career in ex Japanese National Railways (JNR) and then joined Railway Technical Research Institute (RTRI) when JNR was divided and privatized. In RTRI, he consistently engaged in the research of scheduling algorithms in railways. Since 2007, he has been working as a professor in the department of computer science in Chiba Institute of Technology, where he is continuing research about scheduling algorithms in railways.

He was serving as a board member of Japan Transport Safety Board (JTSB) for about ten years, which is a national organization to conduct investigation to determine the causes of aircraft, railway and marine accidents.

Professor TOMII is also acting in international societies. He is the President of IAROR (International Association of Railway Operations Research) and serves as a conference co-chairperson of COMPRAIL (International conference on Railway Engineering Design and Optimization).

Mr. Yasushi Ujita

Director, Vehicle Structure Technology Division, Railway Technical Research Institute, Japan

Research Activities by RTRI for High-speed and Commuter Rolling Stock

Abstract. It is the most important aspect for the railway transportation to improve safety and reliability, especially in case of high-speed operation carrying a large number of passengers. Since the start of high-speed operation of the Tokaido-Shinkansen bullet trains in 1964, Japanese railway has been proud of no passengers' fatalities on board caused by railway accidents except one arson attack case, as the result. In order to prevent the railway accidents for high-speed operation, highly reliable and sophisticated signaling equipment, i.e. automatic train protection and control system have been developed. No level crossing has been installed along the Shinkansen tracks for eliminating the risk of collision accidents. On the other hand, we in Japan often experience the natural disaster, i.e. earthquake, extreme weather condition including strong storm and heavy snow fall. So, there have been a lot of research and development in order to achieve the disaster prevention. About this strategy, it is basically very successful, although there were three derailment accident cases of Shinkansen trains caused by terrible earthquake. Such the derailment phenomena by the huge quakes has been examined and estimated, then we in Japan are developing the countermeasures for reducing the risk of derailments of rolling stocks and the large deviation from the rails against the earthquake.

Here, general topics and several research activities by the RTRI concerning high-speed and commuter rolling stock for improving the safety and also the riding comfort, as well, will be shown and explained in this symposium.

About the speaker. Mr. Ujita graduated from the graduate school of Osaka University majoring in mechanical engineering in 1992. Then he joined Railway Technical Research Institute (RTRI) as a researcher of Vehicle Technology Research Division. His main research subject is structural strength of rolling stock, especially focused into the carbody structure and passive safety of railway vehicles, i.e. crashworthiness. In 2000, he temporally moved to the Advanced Railway Research Centre, University of Sheffield, UK, then he moved to the Imperial College London and worked as a visiting researcher of department of mechanical engineering until 2002. After his back in RTRI, he got the position as a manager of planning division of RTRI in 2005, senior researcher of Vehicle structure Technology division in 2008, head of Vehicle and Bogie Parts Strength Laboratory in 2010. In 2014, he became the General Manager of R&D promotion division and managed to promote all research projects in RTRI, research collaboration with both Japanese domestic organizations and the International organization and oversea railway operators and association, as well as arranging the government subsidy. Since 2016, he is the Director, Vehicle Structure Technology Division.

He is a memeber of the Japan Society of Mechanical Engineers (JSME) , the Society of Materials and Science, Japan (JSMS), Japan Ergonomics Society (JES), Japan Railway Engineers' Association (JREA) and Japan Railway Rolling Stock and Machinery Association (JRMA).

Dr. Yu Qian

Assistant Professor, Department of Civil and Environmental Engineering, College of Engineering and Computing, University of South Carolina, US

Railroad Infrastructure 4.0: Development and Application of an Automatic Ballast Support Condition Assessment System

Abstract. Industry 4.0, or the fourth industrial revolution, is the current trend of automation and data exchange in manufacturing technologies. Originated from the German government's high-tech strategy, the underlying concept of Industry 4.0 is to create "cyber-physical systems" (CPS) that connect smart production facilities which in-turn generate a convergence between industry, business, and internal functions and processes. Even though Industry 4.0 was a manufacturing initiative, the idea of bridging digital and physical systems can be expanded beyond the manufacturing industry. "Railroad Infrastructure 4.0" is thus proposed to revolutionize the maintenance operations of the railroad industry. In North America, most primary freight and passenger rail corridors are constructed using ballasted track. One of the primary maintenance activities is to ensure the ballast is performing adequately. Being able to monitor the ballast condition and conduct tamping operations (e.g. maintenance activities) at optimal intervals can increase the safety and efficiency of railroad operations. Previously, techniques such as ground penetrating radar (GPR) and Matrix Based Tactile Surface Sensors (MBTSS) have been used to assess the condition of ballast, but these investigative tools lack the capability of automatically and continuously monitoring the track system. We have developed a non-intrusive method as a key component of Railroad Infrastructure 4.0 to continuously quantify ballast pressure distribution (i.e. ballast condition) under crossties. This method innovatively uses the bending moment profile across the concrete sleeper (as known as crosstie), and the approximated rail seat loads as inputs, to back-calculate the ballast support condition through the use of an optimization algorithm. The information presented here demonstrates the concept and potential of Railroad Infrastructure 4.0 as the future framework for railroad maintenance operations.

About the speaker. Dr. Yu Qian is assistant professor at the University of South Carolina. He obtained his Bachelor's degree in structural engineering from the Huazhong University of science and technology; Master's degree, with honor, in geotechnical engineering from the University of Kansas; second Master's degree in theoretical and applied mechanics, and Ph.D. in railroad engineering both from the University of Illinois at Urbana-Champaign.

He has been working on transportation infrastructure related research for 10 years, including heavy haul, urban transit, and high-speed railroad. His research interests mainly focus on intelligent railroad infrastructure design and maintenance, discrete and finite element simulation, image analysis, and geosynthetics application. He has published more than 70 journal articles, conference papers, and technical reports. He is currently serving as the Secretary of ASCE Rail Transportation Committee, committee member for three Committees at the Transportation Research Board (TRB), and two Committees at the American Railway Engineering and Maintenance of Way Association (AREMA).

Dr. Melody Khadem Sameni

Assistant Professor, School of Railway Engineering, Iran University of Science and Technology, Iran

"How to Measure and Compare Safety Performance of Railways"?

Abstract. DMAIC is a famous five stage improvement process of defining, measuring, analyzing, improving and controlling performance. For the case of railway safety, there have been indices such as total number of accidents, total number of fatalities, serious injuries and number of derailments for measuring and comparing performance. Railways face a challenge for choosing a single comprehensive index that can be used for showing their overall safety level. Indices such as "Global Safety Index" was been developed by International Union of Railways that use different weights for different accidents to come up with a single measure. Safety performance is also strongly dependent on the volume of passenger and freight traffic. Hence for doing comparisons, traffic volume needs to be taken into account. In this presentation we focus on the measure stage of DMAIC cycle, review existing methods and challenges and suggest novel approaches for measuring safety of operations.

About the speaker. Melody Khadem Sameni is an Assistant Professor at the School of Railway Engineering, Iran University of Science and Technology where she got her bachelor degree of railway transportation engineering. After a master of industrial engineering, she did her PhD at the University of Southampton in the UK. Apart from her activities in the academia, she has several years of working experience at the railway industry as an expert as well as advisor.

Mr. Chau Fat Chan

Assistant Director/ Railways, Electrical & Mechanical Services Department, Government of the Hong Kong Special Administrative Region, Hong Kong

Innovative Approaches for High Speed Rail Safety of Hong Kong

Abstract. The opening of the 26 km long Hong Kong Section of XRL represents Hong Kong has been included in the 25,000 km high-speed network of Mainland. The Government has established a regulatory framework setting out how a constructed high-speed railway system should be safely operated. Although railway operations in Hong Kong are ranked among the best for safety performance in international benchmarking, high-speed rail is still new to the operator and the Government. As Railways Branch (RB) of the Electrical & Mechanical Services Department (EMSD) of the Government of Hong Kong SAR is the regulatory body empowered by legislation to ensure the railway safety in Hong Kong, RB adopted a new regulatory regime to ensure the high-speed rail safety. This presentation will give an overview on the railway safety regulatory framework in Hong Kong and describe how innovative approach being adopted by RB for effective regulation on high-speed rail safety.

About the speaker. Mr CF Chan is the head of the railway safety regulator in Hong Kong responsible for technical endorsement of new railway lines, promotion of railway safety, and regulating the safety performance of the railway operator, MTR in Hong Kong. His regulatory jurisdictions cover also other railway systems in Hong Kong, including the Hong Kong International Airport Driverless Train System, Hong Kong Tramway, and the Peak Tram in Hong Kong.

Mr Chan joined the Hong Kong Government in 1986. Since then, he has taken up various duties in government Bureau & Department, including the formulation of public works policy in the Development Bureau, engineering project management, quality & safety, operation & maintenance of government building engineering systems, electricity safety legislation & enforcement, and his current railway safety regulatory works in the Electrical and Mechanical Services Department under the Transport and Housing Bureau.

Mr Chan is also actively participating in the learned society of engineers in Hong Kong. He was the Council Member of the Hong Kong Institution of Engineers (HKIE) during 2013-2017. He was also the 2016-17 Chairman of the HKIE Electrical Division. In the field of quality assurance, Mr Chan is the Council Member of the Governing Council of the Hong Kong Quality Assurance Agency.

Note

Note

Project website:
http://www.cityu.edu.hk/csie/TBRS/

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Tat Chee Avenue, Kowloon, Hong Kong

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