Editorial

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Biographical notes: Wei-Liang Jin is a Professor of Structural Engineering at Zhejiang University where he served as the Head of the Institute of Structural Engineering and Deputy Dean of the College of Civil Engineering and Architecture. He commenced his academic career at the Zhejiang University, where he rose to the rank of Professor in Structural Engineering in 1996. Author of more than 200 research papers, he continues active structural research and is on the board of several academic journals. He is also member of editorial committee of several national structural technological standards.

Tamon Ueda is a Professor at the Division of Built Environment of Hokkaido University. He obtained his PhD in Engineering from the University of Tokyo in 1982. His research interests are in numerical analysis of concrete and hybrid structures, prediction of chronological change in structural performance, upgrading of structures, seismic design and structural design methodology. He is currently the Chairman of the International Committee on Concrete Model Code (ICCMC) for Asia, Vice President of Asian Concrete Federation (ACF) and Secretary of ISO/TC71/SC7 (Maintenance and Repair of Concrete Structures).

Long-Yuan Li is currently a Senior Lecturer in the School of Civil Engineering, The University of Birmingham. His research interest includes: durability of reinforced concrete structures, cold-formed steel sections, structural impact, fire safety of concrete structures and durability of organic coating. He is a fellow of The Institution of Structural Engineers, member of the UK Society for Computational Mechanics in Engineering, member of the UK Concrete Society and member of the International Society for Interaction of Mechanics and Mathematics. He is a member of the Editorial Board of several international academic journals.

This special issue is devoted to the theoretical studies and various applications on durability of concrete structures. The special issue contains 13 technical papers. The paper by Lars-Olof Nilsson 'Models for chloride ingress into concrete – from Collepardi to today' opens this special issue of the journal. An overview is given of the fundamental differences between various models, from those based on Fick's second law and constant or time-dependent diffusion coefficients and surface chloride contents to those based on chloride transport equations with or without a multi-species approach.

'Influence of surface impregnation with silane on penetration of chloride into cracked concrete and on corrosion of steel reinforcement' is experimentally examined by Folker H. Wittmann, Tie-jun Zhao, Zhao-jun Ren and Ping-gong Guo. The influence of cracks on the efficiency of water repellent surface impregnation has been studied and results will be briefly presented in this paper.

Based on these results, recommendations for applications in practice could be formulated.

The 'Numerical assessment of concrete's self-healing potentials for promoting durability' is presented by Huan He, Zhanqi Guo, Piet Stroeven and Martijn Stroeven. This study investigates the self-healing capacity of modelled bulk concrete by a concurrent algorithm-based simulation system. The impact of some principal design parameters of concrete, e.g., cement fineness, water to cement ratio, on geometric structure of unhydrated cement paste was assessed. Their influences on crack healing capacity were also evaluated by an explicit numerical approach.

A numerical simulation method, namely the mesoscopic truss network model, is developed by Licheng Wang and Tamon Ueda to investigate the chloride ions diffusion in frost-damaged concrete focusing on the effect of frost-induced cracks in 'Mesoscopic simulation of chloride ions diffusion in frost-damaged concrete'. The proposed method can satisfactorily simulate the chloride diffusion process in a frost-damaged concrete based on some experimental findings.

Experimental investigation and theoretical model for corrosion rate of steel bars in concrete under high humidity conditions are presented by Ou Geng, Yingshu Yuan and Fumin Li in 'Study on the corrosion rate of steel bars in concrete under high humidity conditions'. The effects of water-cement ratio, thickness of concrete cover and the position of the steel bar to the corrosion rate of steel bar are also examined.

Material tests and analyses are presented by Silvia B. Uchoa, Indrajit Ray, Julio F. Davalos and Josealdo Tonholo to investigate the most representative test standard ASTM C 1202 rapid chloride permeability test (RCPT), modified RCPT, electrical conductivity metre, electrochemical impedance spectroscopy (EIS) and salt-ponding tests in 'Comparative studies of chloride permeability, conductivity and salt-ponding tests of concrete containing different admixtures'.

Xiao-Zhou Wang and Wei-Liang Jin proposed a corrosion risk assessment model of reinforced concrete structure subject to marine environment, which is presented in 'Spatial variability-based corrosion risk assessment and strategy of repair and maintenance for RC structures'. Class division for the corrosion risk of reinforcement is convenient to rank the condition of existing reinforced concrete and reliability-based cost analysis helps to reach an optimal strategy of repair and maintenance efficiently in life cycle management.

'Chloride-induced corrosion of reinforcement and its effect on performance of structures' is presented by Hiroshi Yokota, Ema Kato and Mitsuyasu Iwanami. Through tests and analyses of reinforced concrete slabs taken out from existing open-type piers that have been in service for 30 to 40 years, variation in chloride ion profiles of concrete, variation in corrosion properties of reinforcement embedded in concrete and influence of the reinforcement corrosion on the load-carrying capacity of the concrete slabs are discussed: the calculation parameters for the prediction of decreasing in load-carrying capacity of concrete members with chloride-induced corrosion of reinforcement are also presented.

In 'Model analysis of the transportation of chloride into concrete expoured on dry-wet cycle condition', Dong Rongzhen, Wei Jun and Yu Jing presented a polynomial model of chloride ions transporting inside the concrete. The model was both verified by the test results and numerical calculation results.

The shear behaviour of corroded reinforced concrete beams is examined by Yu-Xi Zhao, Ju Chen and Wei-Liang Jin in 'Design of shear strengths of corroded reinforced concrete beams'. A series of recent experimental investigations on shear strength of corroded reinforced concrete beams have been reviewed in this paper. The experimental results have been analysed and compared with the predicted failure loads determined from a number of shear strength equations. An empirical equation describing the relationship between the residual shear strength of corroded reinforced concrete beams and the cross-sectional loss of stirrups has been established.

Recent development in long-term behaviour of concrete structures externally strengthened with fibre reinforced polymer (FRP), particularly focusing on the FRP-concrete interface subjected to sustained and fatigue loads are presented by Zhishen Wu and Hesham Diab in 'Modelling of time-dependent bonding and debonding in structures externally strengthened with fibre reinforced polymer sheets'. Some suitable time-dependent models for creep and fatigue loading are also introduced. In addition, a comparison between available guidelines and recommendations with the experimental results of time-dependent loading is presented.

A finite element model of simply supported pretensioned inverted T-beam with circular web openings is developed by Hock Tian Cheng, Bashar S. Mohammed and Kamal Nasharuddin Mustapha in 'Interaction diagram and response surface plot of pretensioned inverted T-beam with circular web openings'. The results from non-linear finite element analysis were verified by test results from five pretensioned inverted T-beams with web opening and one solid beam. The effect of openings on the behaviour of such beams at different stages of loading are presented.

'Real-time monitoring of covercrete response to environmental action' is presented by W. John McCarter, Thomas M. Chrisp, Gerry Starrs and Muhammed Basheer. A temperature correction protocol was developed and based on an Arrhenius relationship to evaluate the activation energy for the conduction process in this paper. The important aspect of the work lies in the use of field data to evaluate and fine-tune the activation energy for each electrode level on the embedded electrode array.