Postprint of article in Special Issue on Model-Based Software Testing, *Journal of Systems and Software* **81** (2): 159–160 (2008)

Editorial

1. Background

Software testing is the most popular and practical means of ensuring software quality in real-life applications. In spite of its viability, however, inadequacies in software testing account for an economic loss of 22–60 billion dollars per year in the United States alone. Instead of testing software in an ad hoc fashion, more systematic and effective approaches are required.

Model-based software testing generally refers to test case generation and result evaluation based on structural and behavioral models of the target software. It provides a more rigorous and scientific way to tackle the issue. System behaviors are predicted by the models and tested and verified via the test cases generated. Unlike model checking, model-based testing is not necessarily styled after finite-state machines. Other models with a formal semantics, as well as semi-formal and informal models, have also been proposed and found to be useful. This approach also concurs with the current emphasis on modeling methods in software specification and design. In this way, we can better verify whether an implementation conforms to the specification of the system under construction.

Model-based software testing has great potential in significantly advancing the effectiveness of software testing. This special issue serves as a forum for researchers and practitioners to present their insights and experience in the theory, applications, tools, and techniques of model-based testing.

2. The papers

We are pleased to report that the interest in the special issue was overwhelming. We received a total of 43 submissions. The following eight papers have been accepted with an acceptance rate of 18.6%. They represent a good cross section of topics in model-based software testing.

The first paper, "*Traffic-Aware Stress Testing of Distributed Real-Time Systems Based on UML Models Using Genetic Algorithms*" by Garousi, Briand, and Labiche, boosts the detection of network traffic-related faults in distributed real-time systems using a UML model-driven stress testing approach.

The next paper, "*Applying Machine Learning to Software Fault-Proneness Prediction*" by Gondra, investigates the use of a machine learning approach to select software metrics that are most likely to predict software faults.

The third paper, "*Experiments with Test Case Prioritization Using Relevant Slices*" by Jeffrey and Gupta, presents a relevant slicing approach to identify output-influencing and potentially-output-influencing statements and branches and, hence, develops a test case prioritization technique for regression testing.

The fourth paper, "*Testing Input Validation in Web Applications through Automated Model Recovery*" by Liu and Tan, proposes to recover an input validation model automatically from source code. This model serves as a basis for two coverage criteria for the testing of Web applications.

The fifth paper, "*A Relation-Based Method Combining Functional and Structural Testing for Test Case Generation*" by Liu and Chen, presents a method that integrates specification- and implementation-based testing by defining relations among different types of variable and applying such relations to input variables of the program for test case generation.

A dynamic error flow analysis model is proposed in the sixth paper, "*An Empirical, Path-oriented Approach to Software Analysis and Testing*" by Murrill. A corresponding testing strategy applies the information derived from the model to select optimal sets of test paths and to quantify success measures in software testing.

The seventh paper, "*A Search-Based Framework for Automatic Testing of MATLAB/Simulink Models*" by Zhan and Clark, discusses model-level analogues of code-level coverage criteria and applies heuristic search techniques to address a fundamental limitation of mutation testing.

Based on an object-oriented formal model, a set of test case generation methods is presented in the final paper, "*Automated Generation of Test Suites from Formal Specifications of Real-time Reactive Systems*" by Zheng, Alagar, and Ormandjieva. A metric-based algorithm is developed for the selection of test cases that are sufficient to test a real-time reactive system.

Acknowledgements

We thank the authors for sharing their ideas and results with us, and the many reviewers for their invaluable feedback on the papers. Special thanks also go to Dr. David Card for his encouragement and support.

T.H. Tse is a Professor in Computer Science at The University of Hong Kong. He received his PhD in Information Systems from the London School of Economics and was a Visiting Fellow at the University of Oxford. He is an editor of the *Journal of Systems and Software*, *Software Testing, Verification and Reliability*, and the *Journal of Universal Computer Science*. He has been the steering committee chair of QSIC since 2003, a steering committee member of COMPSAC since 2002, the general chair of SOSE 2007, the program chair of COMPSAC 2001, and a program co-chair of APAQS 2000. He is a fellow of the British Computer Society, a fellow of the Institute for the Management of Information Systems, a fellow of the Institute of Mathematics and its Applications, a fellow of the Hong Kong Institution of Engineers and a senior member of the IEEE. He was selected for a "Ministry of Education Nominated State Science and Technology Award" in China. He was decorated with an MBE by The Queen.

W. Eric Wong received his BS in Computer Science from Eastern Michigan University and his MS and PhD in Computer Science from Purdue University. He is currently an Associate Professor in the Department of Computer Science at the University of Texas at Dallas. He is a recipient of the Quality Assurance Special Achievement Award from Johnson Space Center, NASA (1997). Prior to joining UTD, he was with Telcordia Technologies (formerly Bellcore) as a Senior Research Scientist and as the project manager in charge of the initiative for Dependable Telecom Software Development. His research focus is on the development of technology to help practitioners produce high quality software at low cost. In particular, he is doing research in the areas of software testing, maintenance, reliability, metrics, and QoS at the application, as well as architectural design, level. He has published over 100 refereed papers in journals and conference/workshop proceedings. He has served, or is serving, as a special issue guest editor for the *Journal of Systems and Software*, *Software: Practice and Experience*, *Software Quality Journal*, the *International Journal of Software Engineering and Knowledge Engineering*, and the *Journal of Software Testing, Verification & Reliability*, and as a program chair for SSIRI 2008, QSIC 2007, ACM SAC SE Track 2008 & 2007, IWSC 2007 & 2006, Mutation 2006, ISSRE 2005, SEKE 2005, and COMPSAC 2004.

T.H. Tse
Department of Computer Science
The University of Hong Kong
Pokfulam, Hong Kong
Tel.: +852 2859 2183; fax: +852 2858 4141
E-mail address: thtse@cs.hku.hk

W. Eric Wong
Department of Computer Science
The University of Texas at Dallas
Richardson, TX 75083, USA
Tel.: +1 (972) 883-6619; fax: +1 (972) 883-2349
E-mail address: ewong@utdallas.edu