Byeong-Yun Chang
Changbeom Choi (Eds.)

Communications in Computer and Information Science 1636

Methods and Applications for Modeling and Simulation of Complex Systems

20th Asian Simulation Conference, AsiaSim 2021
Virtual Event, November 17–20, 2021
Proceedings

Springer

ASIASIM

Communications in Computer and Information Science 1636

Editorial Board Members

Joaquim Filipe
Polytechnic Institute of Setúbal, Setúbal, Portugal

Ashish Ghosh
Indian Statistical Institute, Kolkata, India

Raquel Oliveira Prates
Federal University of Minas Gerais (UFMG), Belo Horizonte, Brazil

Lizhu Zhou
Tsinghua University, Beijing, China

More information about this series at https://link.springer.com/bookseries/7899

Byeong-Yun Chang · Changbeom Choi (Eds.)

Methods and Applications for Modeling and Simulation of Complex Systems

20th Asian Simulation Conference, AsiaSim 2021
Virtual Event, November 17–20, 2021
Proceedings

Springer

Editors
Byeong-Yun Chang
Ajou University
Suwon, Korea (Republic of)

Changbeom Choi
Hanbat National University
Daejeon, Korea (Republic of)

ISSN 1865-0929 ISSN 1865-0937 (electronic)
Communications in Computer and Information Science
ISBN 978-981-19-6856-3 ISBN 978-981-19-6857-0 (eBook)
https://doi.org/10.1007/978-981-19-6857-0

© Springer Nature Singapore Pte Ltd. 2022
This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.
The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.
The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Preface

The Asian Simulation Conference (AsiaSim) started in 2001 and has been organized by KSS (Korea Society for Simulation), SSAGsg (Society of Simulation and Gaming of Singapore), JSST (Japan Society for Simulation Technology), CSF (China Simulation Federation), and MSS (Malaysian Simulation Society) as an academic event representing Asia. AsiaSim is an event where experts in modeling and simulation from various fields in Asia gather to share research results and broaden relationships.

AsiaSim is an annual academic event, but unfortunately, the conference could not be held in 2020 due to the COVID-19 pandemic. However, in 2021, AsiaSim was held in the metaverse, where modeling and simulation technology is the basis of the service. In the metaverse, every participant experienced convergence between the real world and the virtual world.

Research results on various topics, from modeling and simulation theory to manufacturing, defense, transportation, and general engineering fields that combine simulation with computer graphics simulations, were shared at the AsiaSim 2021 academic event venue built in the metaverse. Three reviewers evaluated each contribution. A total of 19 papers were presented in the oral session, and four were presented in the poster session. Among them, only nine papers were finally accepted for this CCIS volume.

We thank the keynote speakers, David Goldsman, Byunghee Kim, Lin Zhang, and Satoshi Tanaka, for giving great insights to the attendees. Furthermore, we wish to thank the external reviewers for their time, effort, and timely response. Also, we thank the Program Committee and Organizing Committee members who made the conference successful. Finally, we thank the participants who participated remotely despite the difficult circumstances.

July 2022

Byeong-Yun Chang
Changbeom Choi

Organization

Honorary Chairs

Sung Jo Hong	Dongguk University, South Korea
Yun Bae Kim	Sungkyunkwan University, South Korea
Axel Lehmann	Universität de Bundeswehr München, Germany

General Chair

Byeong-Yun Chang	Ajou University, South Korea

General Co-chairs

Bo Hu Li (President of CSF)	Beihang University, China
Kazuo Furuta (President of JSST)	University of Tokyo, Japan
Yahaya Md Sam (President of MSS)	Universiti Teknologi Malaysia, Malaysia
Gary Tan (President of AsiaSim and President of SSAGSG)	National University of Singapore, Singapore

Program Chair

Changbeom Choi	Hanbat National University, South Korea

Organizing Committee

Jinsoo Park	Yong In University, South Korea
Heesuk Seo	Korea University of Technology Education, South Korea
Se Won Lee	Pukyong National University, South Korea

Publication Committee

Jonghun Lee	Daegu Gyeongbuk Institute of Science and Technology, South Korea
Jung Wook Baek	Chosun University, South Korea
Hae Young Lee	Cheongju University, South Korea
Yongwhan Park	Yeungnam University, South Korea
Sang Ahn Kim	Siena College, South Korea

Jong-ho Shin	Chosun University, South Korea
Jin Myoung Kim	Ministry of National Defense, South Korea
Su Man Nam	DuDuIT, South Korea
Gyu M. Lee	Pusan National University, South Korea

Industrial Committee

Jonghun Lee	Daegu Gyeongbuk Institute of Science and Technology, South Korea
Sang Dong Kim	Daegu Gyeongbuk Institute of Science and Technology, South Korea
Jeong Tak Ryu	Daegu University, South Korea
Young Suk Park	Atworth Co., Ltd., South Korea
Ku-kil Chang	Dassault Systemes Korea, South Korea
Young Gyo Chung	SimTech Systems, Inc., South Korea
Seong-Hoon Choi	Sangmyung University, South Korea

Award Committee

Dong-Won Seo	Kyung Hee University, South Korea
Hyung Jong Kim	Seoul Women's University, South Korea
Byungjoo Park	Hannam University, South Korea
Sungsu Kim	Kyungpook National University, South Korea
Seung Hyun Yoon	Electronics and Telecommunications Research Institute, South Korea
Jiyeon Kim	Seoul Women's University, South Korea
Jin Hyung Kim	Korea Internet & Security Agency, South Korea
Eun Young Jang	LG Uplus Corp., South Korea

International Program Committee

Changbeom Choi	Hanbat National University, South Korea
Sooyoung Jang	Electronics and Telecommunications Research Institute, South Korea
Kyung-Min Seo	Korea University of Technology Education, South Korea
Jangwon Bae	Korea University of Technology Education, South Korea
Kyoungchan Won	Center for Army Analysis & Simulation, South Korea
Gyu M. Lee	Pusan National University, South Korea
Bohu Li	Beijing University of Aeronautics and Astronautics, China

Liang Li	Ritsumeikan University, Japan
Satoshi Tanaka	Ritsumeikan University, Japan
Lin Zhang	Beihang University, China
Terence Hung	Rolls Royce, Singapore
Dong Jin	Illinois Institute of Technology, USA
Farzad Kamrani	KTH Royal Institute of Technology, Sweden
Helen Karatza	Aristotle University of Thessaloniki, Greece
Sye Loong Keoh	University of Glasgow, Singapore, Singapore
Yun Bae Kim	Sungkyunkwan University, South Korea
Ge Li	National University of Defence Technology, China
Zengxiang Li	Institute of High Performance Computing, A*STAR, Singapore
Malcolm Low	Singapore Institute of Technology, Singapore
Linbo Luo	Xidian University, China
Imran Mahmood	National University of Sciences & Technology, Pakistan
Yahaya Md Sam	Universiti Teknologi Malaysia, Malaysia
Zaharuddin Mohamed	Universiti Teknologi Malaysia, Malaysia
Navonil Mustafee	University of Exeter, UK
Bhakti Stephan Onggo	University of Southampton, UK
Ravi Seshadri	Singapore-MIT Alliance for Research and Technology, Singapore
Xiao Song	Beihang University, China
Yuen Jien Soo	National University of Singapore, Singapore
Claudia Szabo	University of Adelaide, Australia
Sun Teck Tan	National University of Singapore, Singapore
Wenjie Tang	National University of Defense Technology, China
Yifa Tang	Chinese Academy of Sciences, China
Simon Taylor	Brunel University, UK
Yong Meng Teo	National University of Singapore, Singapore
Georgios Theodoropoulos	Southern University of Science and Technology, China
Stephen John Turner	Vidyasirimedhi Institute of Science and Technology, Thailand
Bimlesh Wadhwa	National University of Singapore, Singapore
Yiping Yao	National University of Defense Technology, China
Allan N. Zhang	Singapore Institute of Manufacturing Technology, Singapore
Jinghui Zhong	South China University of Technology, China

Additional Reviewers

Kangsun Lee
Jun-Gyu Kang
Seon Han Choi
Sang-Hwan Kim
Nam-Su Ahn
Jinho Lee
Heungseob Kim
Dohyung Kim
Sangjin Lee
Junghoon Kim
Kyungtae Lim
Taehoon Kim
Haneol Jang

Contents

Simulation and Visualization

Toward Agent-Based In Situ Visualization 3
Yan Wang, Ren Sakai, and Akira Kageyama

Application of the Edge Upsampling Network to Soft-Edge Regions in a 3D-Scanned Point Cloud 11
Weite Li, Kyoko Hasegawa, Liang Li, Akihiro Tsukamoto, Yamaguchi Hiroshi, Fadjar I. Thufail, Brahmantara, and Satoshi Tanaka

A Visual Analytics Method for Time-Series Log Data Using Multiple Dimensionality Reduction 19
Keijiro Fujita, Naohisa Sakamoto, Takanori Fujiwara, Jorji Nonaka, and Toshiyuki Tsukamoto

Modeling and Simulation of Systems

Comparing the Conversion Effects of Toll Operations for Seoul Tollgate Using Arena 31
Seung-Min Noh and Seong-Yong Jang

CollabOffloading: A Computational Offloading Methodology Using External Clouds for Limited Private On-Site Edge Servers 44
Junhee Lee, Jaeho Jeon, and Sungjoo Kang

Experiments on the Battle Trend and Result of Combat21 Model and VBS4 . . . 56
Jonggill Lee, Heenam Lee, Koangsu Lee, Hongpil Choi, Seungmin Lee, and Jaeho Im

A Study on SES-Based Information Security Framework for Autonomous Vehicle Controlling Environment 68
Hyung-Jong Kim and Hwahyeon Park

Cross-Retransmission Techniques in Licensed and Unlicensed Spectrum Bands over Wireless Access Networks 74
Eunkyung Kim

Beneficial Online Price Coordination in the O2O Era Added Mobile Channel 86
Yang Bai and Wenqi Song

Author Index 101