# **Lecture Notes in Computer Science**

# 13034

# Founding Editors

Gerhard Goos

Karlsruhe Institute of Technology, Karlsruhe, Germany

Juris Hartmanis

Cornell University, Ithaca, NY, USA

#### **Editorial Board Members**

Elisa Bertino

Purdue University, West Lafayette, IN, USA

Wen Gao

Peking University, Beijing, China

Bernhard Steffen

TU Dortmund University, Dortmund, Germany

Gerhard Woeginger

RWTH Aachen, Aachen, Germany

Moti Yung

Columbia University, New York, NY, USA

More information about this subseries at http://www.springer.com/series/7407

Jin Akiyama · Reginaldo M. Marcelo · Mari-Jo P. Ruiz · Yushi Uno (Eds.)

# Discrete and Computational Geometry, Graphs, and Games

21st Japanese Conference, JCDCGGG 2018 Quezon City, Philippines, September 1–3, 2018 Revised Selected Papers



Editors Jin Akiyama Tokyo University of Science Tokyo, Japan

Mari-Jo P. Ruiz Ateneo de Manila University Quezon City, Philippines Reginaldo M. Marcelo Ateneo de Manila University Quezon City, Philippines

Yushi Uno Osaka Prefecture University Osaka, Japan

ISSN 0302-9743 ISSN 1611-3349 (electronic) Lecture Notes in Computer Science ISBN 978-3-030-90047-2 ISBN 978-3-030-90048-9 (eBook) https://doi.org/10.1007/978-3-030-90048-9

LNCS Sublibrary: SL1 - Theoretical Computer Science and General Issues

#### © Springer Nature Switzerland AG 2021

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 Switzerland AG The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

### **Preface**

This volume consists of selected papers presented at the 21st Japan Conference on Discrete and Computational Geometry, Graphs, and Games (JCDCGGG 2018) held on September 1–3, 2018, at Ateneo de Manila University in Quezon City, Philippines. The conference is part of the series which started out as the Japan Conference on Discrete and Computational Geometry (JCDCG) in 1997, organized by Jin Akiyama (of Tokai University at the time) and his colleagues. Conferences in the series have been held annually, except for the years 2008 and 2020, usually in Japan, although some were hosted by other Asian countries such as the Philippines, Thailand, China, and Indonesia. Graphs became one of the conference topics soon after the series started, while Games were included recently.

We are very grateful to the more than 70 referees who reviewed a total of 30 submitted papers. We thank the authors for their patience and cooperation during the back-and-forth process of comments and revisions initiated by the editors and the referees, especially since the process slowed down at the onset of the COVID-19 pandemic late in 2019 through 2020. Finally, we thank the Springer team for the ready assistance, as we learned and complied with the publication requirements.

August 2021

Jin Akiyama Reginaldo M. Marcelo Mari-Jo P. Ruiz Yushi Uno

# **Organization**

#### **Conference Chairs**

Jin Akiyama Tokyo University of Science, Japan Mari-Jo P. Ruiz Ateneo de Manila University, Philippines

## **Organizing Committee**

Agnes Garciano Ateneo de Manila University, Philippines
Hiro Ito University of Electro-Communications, Japan

Mikio Kano Ibaraki University, Japan

Reginaldo M. Marcelo Ateneo de Manila University, Philippines

Toshinori Sakai Tokai University, Japan

Jumela Sarmiento Ateneo de Manila University, Philippines

Yushi Uno Osaka Prefecture University, Japan

## **Program Commitee**

Reginaldo M. Marcelo
Ian June Garces
Agnes Garciano

Mikio Kano

Ateneo de Manila University, Philippines
Ateneo de Manila University, Philippines
Ateneo de Manila University, Philippines
Ibaraki University, Japan

Mikio Kano Ibaraki University, Japan Toshinori Sakai Tokai University, Japan

Mark Anthony Tolentino Ateneo de Manila University, Philippines

Yushi Uno Osaka Prefecture University, Japan

#### Secretariat

Mark Anthony Tolentino Janree Ruark Gatpatan Jonn Angel Aranas Luis Silvestre, Jr. Engel John Dela Vega Immanuel Gabriel Sin

## Logistics

Jakov Dumbrique

Jude BuotEdrian NeverioMark LoyolaLu Christian OngEurlyne DomingoRenzo Roel TanJoanna CardiñoLean Franzl YaoPatrick John FernandezAnthony Zosa

**Edwin Morales** 

# Finance

Jumela Sarmiento Editha Bagtas

# **Contents**

On Geometric Graphs on Point Sets in the Plane	1
The Two-Distance Sets in Dimension Four	18
Negative Instance for the Edge Patrolling Beacon Problem	28
Global Location-Domination in the Join and Cartesian Product of Graphs Analen Malnegro and Gina Malacas	36
The Metric Dimension of the Join of Paths and Cycles	43
Barnette's Conjecture Through the Lens of the $Mod_kP$ Complexity Classes	59
Hamiltonicity of Graphs on Surfaces in Terms of Toughness and Scattering Number – A Survey	74
On Structural Parameterizations of Node Kayles	96
Robustness in Power-Law Kinetic Systems with Reactant-Determined Interactions Noel T. Fortun, Angelyn R. Lao, Luis F. Razon, and Eduardo R. Mendoza	106
Toward Unfolding Doubly Covered n-Stars	122
Crystallographic Flat Origami from <i>n</i> -Uniform Tilings	136
Packing Cube Nets into Rectangles with O(1) Holes	152

	<b>a</b>	
v	Contents	3

On the Complexity of Jelly-no-Puzzle	165
Computational Complexity of Two Pencil Puzzles: Kurotto and Juosan	175
Author Index	187