This book series features volumes composed of select contributions from workshops and conferences in all areas of current research in mathematics and statistics, including operation research and optimization. In addition to an overall evaluation of the interest, scientific quality, and timeliness of each proposal at the hands of the publisher, individual contributions are all refereed to the high quality standards of leading journals in the field. Thus, this series provides the research community with well-edited, authoritative reports on developments in the most exciting areas of mathematical and statistical research today.
Algebraic Design Theory
and Hadamard Matrices

ADTHM, Lethbridge, Alberta, Canada, July 2014

Springer
A Workshop on Algebraic Design Theory and Hadamard Matrices was held at the University of Lethbridge from 8 July to 11 July, 2014. From 11 July to 13 July, 2014, the follow-on workshop Algebraic design theory with Hadamard matrices: applications, current trends and future directions (14w2199) was held at the Banff International Research Station. Current research and future directions in algebraic design theory and its connections with algebra, computation, communication, cryptography, finite geometry, codes, and physics were examined.

At the same time, the workshops celebrated the 70th birthday of Professor Hadi Kharaghani at the University of Lethbridge. Hadi’s contributions to the field have been significant. In 1985, he published a very useful method for constructing some orthogonal matrices, subsequently named Kharaghani matrices. In 1991, he gave the first infinite sequence of Hadamard matrices with maximum excess. In 2000, he constructed one of the largest classes of designs using Kharaghani matrices, introduced twin designs for the first time and developed a new method to generate arrays for orthogonal designs. Together with Behruz Tayfeh-Rezaie, he discovered a Hadamard matrix of order 428 in 2004; the order had been for a long while the smallest order for which no Hadamard matrix was known.

Hadi is an author of more than 85 papers published in refereed journals. He is a Foundation Fellow of the Institute of Combinatorics and its Applications and has been named to the editorial board of the Journal of Combinatorial Designs. Hadi has also organized workshops, conferences, and seminars that have promoted research in combinatorics and increased the University of Lethbridge’s profile and reputation. He has won the top research award and the top teaching award at the University. Lastly at an age when many consider retirement, he has taken on the ultimate challenge—administration—by serving as Chair of the largest department at the university! His 6 year sentence ends in a few years.

This volume contains selected papers from these two workshops. Many people are to be thanked for their roles in running the workshops and ensuring that the proceedings came to fruition. Thanks to the workshop organizers in Lethbridge (Amir Akbary and Wolf Holzmann, University of Lethbridge; K.T. Arasu and Yuqing Chen, Wright State University; Charlie Colbourn, Arizona State University; Robert
Craigen, University of Manitoba; and Vladimir Tonchev, Michigan Technological University), and in Banff (Robert Craigen, University of Manitoba; Dane Flannery, National University of Ireland; and Hadi Kharaghani, University of Lethbridge). Thanks also to all of the speakers and participants for making the meetings scientific successes. Special thanks to Rob Craigen for coordinating the problem section in this proceedings. Finally, thanks to the numerous anonymous reviewers who improved the quality of the papers that you see here.

And thanks to Hadi Kharaghani for his many contributions to algebraic design theory and Hadamard matrices. Happy 70th birthday!

Tempe, AZ, USA
January 2015

Charles J. Colbourn
On (-1,1)-Matrices of Skew Type with the Maximal Determinant and Tournaments ................................................. 1
José Andrés Armario

On Good Matrices and Skew Hadamard Matrices .................... 13
Gene Awyzio and Jennifer Seberry

Suitable Permutations, Binary Covering Arrays, and Paley Matrices ..... 29
Charles J. Colbourn

Divisible Design Digraphs ....................................................... 43
Dean Crnković and Hadi Kharaghani

New Symmetric (61,16,4) Designs Obtained from Codes .................. 61
Dean Crnković, Sanja Rukavina, and Vladimir D. Tonchev

D-Optimal Matrices of Orders 118, 138, 150, 154 and 174 ............... 71
Dragomir Ž. Đoković and Ilias S. Kotsireas

Periodic Golay Pairs of Length 72 .................................................. 83
Dragomir Ž. Đoković and Ilias S. Kotsireas

Classifying Cocyclic Butson Hadamard Matrices ....................... 93
Ronan Egan, Dane Flannery, and Padraig Ó Catháin

Signed Group Orthogonal Designs and Their Applications ............... 107
Ebrahim Ghaderpour

On Symmetric Designs and Binary 3-Frameproof Codes .................. 125
Chuan Guo, Douglas R. Stinson, and Tran van Trung

An Algorithm for Constructing Hjelmslev Planes ....................... 137
Joanne L. Hall and Asha Rao

Mutually Unbiased Biangular Vectors and Association Schemes ........ 149
W.H. Holzmann, H. Kharaghani, and S. Suda
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Simple Construction of Complex Equiangular Lines</td>
<td>159</td>
</tr>
<tr>
<td>Jonathan Jedwab and Amy Wiebe</td>
<td></td>
</tr>
<tr>
<td>Inner Product Vectors for Skew-Hadamard Matrices</td>
<td>171</td>
</tr>
<tr>
<td>Ilias S. Kotsireas, Jennifer Seberry, and Yustina S. Suharini</td>
<td></td>
</tr>
<tr>
<td>Twin Bent Functions and Clifford Algebras</td>
<td>189</td>
</tr>
<tr>
<td>Paul C. Leopardi</td>
<td></td>
</tr>
<tr>
<td>A Walsh–Fourier Approach to the Circulant Hadamard Conjecture</td>
<td>201</td>
</tr>
<tr>
<td>Máté Matolcsi</td>
<td></td>
</tr>
<tr>
<td>A Note on Order and Eigenvalue Multiplicity of Strongly Regular Graphs</td>
<td>209</td>
</tr>
<tr>
<td>A. Mohammadian and B. Tayfeh-Rezaie</td>
<td></td>
</tr>
<tr>
<td>Trades in Complex Hadamard Matrices</td>
<td>213</td>
</tr>
<tr>
<td>Padraig Ó Catháin and Ian M. Wanless</td>
<td></td>
</tr>
<tr>
<td>The Hunt for Weighing Matrices of Small Orders</td>
<td>223</td>
</tr>
<tr>
<td>Ferenc Szöllősi</td>
<td></td>
</tr>
<tr>
<td>Menon–Hadamard Difference Sets Obtained from a Local Field by Natural Projections</td>
<td>235</td>
</tr>
<tr>
<td>Mieko Yamada</td>
<td></td>
</tr>
<tr>
<td>BIRS Workshop 14w2199 July 11–13, 2014 Problem Solving Session</td>
<td>251</td>
</tr>
<tr>
<td>R. Craigen (Problems Editor)</td>
<td></td>
</tr>
</tbody>
</table>
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