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Preface to the special issue on network coding and designs

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This issue of the journal *Designs, Codes and Cryptography* is devoted to Network Coding and Designs. Network Coding has recently attracted much interest due mainly to its relevance for transmission of information in random networks, but, additionally, due to its many links with geometrical problems and q-designs problems, the relevance of network coding surpasses many research areas.

The European Cooperation in Science and Technology (COST) action IC1104 *Random Network Coding and Designs over GF(q)* (2012-2016) (http://www.network-coding.eu/) stimulated a lot of research on these topics. An open call to the researchers of this COST action led to 21 articles submitted for publication to this special issue. After the refereeing process, which was according to the journal's high standards, 10 articles were accepted for publication. These accepted articles cover a variety of areas, ranging from coding-theoretical aspects of network coding, convolutional coding, and distributed storage to cryptographical aspects of network coding, and geometrical aspects of network coding and designs. We briefly describe the contents of the accepted articles.

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Two articles focus on q-designs. The article of M. Kiermaier, S. Kurz and A. Wassermann shows that *The order of the automorphism group of a binary q-analog of the Fano plane is at most two*. A *large set* of q-designs is a partition of the trivial design into pairwise disjoint t-$(v, k, \lambda)_q$-designs. M. Kiermaier, R. Laue and A. Wassermann present *A new series of large sets of subspace designs over the binary field*.

Geometrical aspects also play a role in the article *Network coding with flags*. Here, D. Liebhold, G. Nebe and Á. Vazquez-Castro establish links between the network coding and the geometrical theory of buildings.

P. Almeida, D. Napp and R. Pinto use superregular matrices to construct *MDS 2D convolutional codes with optimal 1D horizontal projections*. A novel coding approach to deal with the transmission of information over a network is presented by D. Napp, R. Pinto and V. Sidorenko in *Concatenation of convolutional codes and rank metric codes for multi-shot network coding*.

The article of A.-L. Horlemann-Trautmann, K. Marshall and J. Rosenthal discusses cryptographical aspects of random network coding. In *Extension of Overbeck's attack for Gabidulin-based cryptosystems*, the authors generalize Overbeck's attack to break the GPT cryptosystem, and extend the attack to cryptanalyze particular variants which explicitly resist Overbeck's attack.

The Gabidulin codes are classical examples of maximum rank distance codes. The article *On the genericity of maximum rank distance and Gabidulin codes* of A. Neri, A.-L. Horlemann-Trautmann, T. Randrianariosa and J. Rosenthal discusses the question of the construction of MRD codes, not equivalent to Gabidulin codes. Their results prove that over a large degree extension field, a random generator matrix generates with high probability a non-Gabidulin MRD code.

For practical applications, it is important that a code has a message encoding map that is efficient to compute, and a corresponding inverse retrieval map. This question is addressed by A.-L. Horlemann-Trautmann in *Message encoding and retrieval for spread and cyclic orbit codes*.

Distributed storage has many links with random network coding. The problem of storing permutations in a distributed manner arises in many settings. Different aspects of the distributed storage of permutations are discussed by N. Raviv, E. Yaakobi and M. Médard in *Coding for locality in reconstructing permutations*. In a second article related to distributed storage, N. Silberstein and A. Zeh present in *Anticode-based locally repairable codes with high availability* new families of locally repairable codes. Their construction methods are inspired by the anticodes, also called minihypers, and, consequently, many of the resulting codes are optimal with respect to the Griesmer bound or the Cadambe–Mazumdar bound, or both.

The open call for articles for this special issue was preceded by the *Network Coding and Designs* conference in Dubrovnik, Croatia, April 4–8, 2016, which was the final conference of the COST Action IC1104 *Random Network Coding and Designs over GF(q)*. These accepted articles therefore constitute a nice overview of aspects of random network coding theory, and related topics, investigated by collaborators of this project.

We invite all readers to keep investigating these aspects and questions, thereby continuing the incentive of the COST action IC1104.