

REPORT ON THE ACTIVITIES OF WG5 AFTER PALMELA (PARTLY OVERLAPPING WITH OTHER WGs)

Camilla Hollanti, Chair of WG5, March 19 2015

The group has been working on lattice codes and algebraic codes with applications to network coding and distributed storage systems, both on the network layer and physical layer. Motivated by the future 5G networks, the groups has also worked on the complexity reduction on space-time codes, especially multiple-access and distributed codes.

1. Papers and preprints

Dusan Jakovetic, Aleksandar Minja, Dragana Bajovic, Dejan Vukobratovic: "Distributed Storage Allocations for Neighbourhood-Based Data Access," IEEE Information Theory Workshop 2015, Jerusalem, Israel, April 2015. ArXiv link: <http://arxiv.org/abs/1411.2746>

Mladen Kovacevic, "Difference Sets and Codes in A_n Lattices," submitted for publication, available at [arXiv:1409.5276](https://arxiv.org/abs/1409.5276).

Daniele Manini, Marco Gribaudo (Politecnico Milano) and Mauro Iacono (Seconda Università di Napoli). "Improving reliability and performances in large scale distributed application with erasure codes and replication", in preparation.

I. Kubjas and V. Skachek, "Data Dissemination Problem in Wireless Networks", submitted to IEEE International Symposium on Information Theory (ISIT 2015), Hong Kong, SAR, June 2015.

Javier de la Cruz, Michael Kiermaier, Alfred Wassermann, Wolfgang Willems, "Algebraic structures of MRD codes", <http://arxiv.org/abs/1502.02711>

Amaro Barreal, Camilla Hollanti, David Karpuk, "Reduced Complexity Decoding of $n \times n$ Algebraic Space-Time Codes", arXiv:1501.06686.

Thomas Westerbäck, Ragnar Freij, Toni Ernvall, Camilla Hollanti, "On the Combinatorics of Locally Repairable Codes via Matroid Theory", arXiv:1501.00153

Amaro Barreal, Camilla Hollanti, Nadya Markin, "Fast-Decodable Space-Time Codes for the N -Relay and Multiple-Access MIMO Channel", arXiv:1412.1257

Joonas Pääkkönen, Camilla Hollanti, Olav Tirkkonen, “Device-to-Device Data Storage with Regenerating Codes”, arXiv:1411.1608

Toni Ernvall, Thomas Westerbäck, Camilla Hollanti, Ragnar Freij, “Constructions and Properties of Linear Locally Repairable Codes” Submitted to IEEE Transactions on Information Theory. arXiv:1410.6339

Iván Blanco-Chacón, Camilla Hollanti, Montserrat Alsina, Dionís Remón “Fuchsian codes with arbitrarily high code rate”,. arXiv:1410.6094

David Karpuk, Camilla Hollanti, Amaro Barreal, “Node Repair for Distributed Storage Systems over Fading Channels”, ISITA 2014, arXiv:1409.7247

David Karpuk, Camilla Hollanti, “Multi-Dimensional and Non-Uniform Constellation Optimization via the Special Orthogonal Group”, ITW 2014, arXiv:1409.7244

2. Short term study missions

From September 1 to November 30, 2014, Emilio Suarez Canedo and Roland Barrolleta from Autonomous University of Barcelona visited Leo's group in Ghent with an STSM.

Together with his postdocs Maarten De Boeck and Peter Vandendriessche, they worked on the following problems:

(this is the report I got from Leo:)

1) Constant dimension codes in $V(n,q)$ consisting of k -dimensional vector subspaces, pairwise intersecting in t -dimensional spaces.

There is a result known stating: if this code is large enough, then it is a sunflower: the code consists of k -dimensional subspaces intersecting pairwise in the same t -dimensional subspace.

We found a theorem giving a similar result based on the dimension n generated by the k -dimensional subspaces.

If the dimension is larger than a certain dimension n_0 , then the code is a sunflower.

Moreover, our bound is sharp. There exist two types of examples of codes whose codewords generate together this dimension n_0 .

2) Constant dimension codes in $V(n,q)$ consisting of k -dimensional vector subspaces, pairwise intersecting in t -dimensional spaces.

Here, we found in the literature the definition of primitive constant dimension codes in $V(n,q)$ consisting of k -dimensional vector subspaces, pairwise intersecting in t -dimensional spaces.

This definition is by J. Einfeld.

One of the conditions is that a codeword has to be generated by its intersections with the other codewords.

J. Einfeld only considered special parameters. At first, we thought there were no other examples.

But we found many new examples of primitive constant dimension codes in $V(n,q)$ consisting of k -dimensional vector subspaces, pairwise intersecting in t -dimensional spaces.

STSM with Vitaly: Jens Zumbraegel

From Dresden University of Technology, Germany, to University of Tartu, Estonia

Dates: 22/9/2014-4/10/2014

Topic: Non-linear binary batch codes

Talk:

The results of the STSM will be presented at ALCOMA by Jens Zumbraegel: On bounds for batch codes, ALCOMA, Germany, March 2015.

STMS with Joachim Rosenthal in UZurich: Camilla Hollanti, Ragnar Freij and Amaro Barreal, mid November to mid December.

Working on expander graphs and DSSs, as well as on the compute&forward physical layer network coding protocol.