

TITLE: Circulant matrices and applications.

ABSTRACT: Circulant matrices have a strong presence in various parts of modern (and classical) mathematics. We present the most important properties of Toeplitz and circulant matrices. We have tried to make the topic accessible to a wide audience by supplying rather full details in most of the arguments. We focus on the application of this kind of matrices to obtain a faster implementation of a matrix-vector product. Once we have reached this goal, we present a concrete use of this fast algorithm in the resolution of a linear system through the Conjugate Gradient Method. The seminar ends with an application of our result to the Image Reconstruction from Radon Data in the setting of CT.

REFERENCES:

- R. M. Gray, *"Toeplitz and Circulant Matrices: A Review."*, Foundation and Trends in Communications and Information Theory, Hanover, 2006.
- G. Golub and C. van Loan, *"Matrix Computations."*, The Johns Hopkins University Press, third edition, Baltimore, 1996.
- Joint Summer Research Conference, University of Colorado, *"Structured Matrices in Mathematics, Computer Science, and Engineering II."*, Vadim Olshevsky Editor, 1999.
- J. Nocedal and S.J. Wright, *"Numerical Optimization."*, Springer, New York, 1999.