

SHORT COURSE: FROM VOLUMETRIC INEQUALITIES IN CONVEX GEOMETRY TO FUNCTIONAL INEQUALITIES

C. HUGO JIMÉNEZ

Lecture 1. (2hr)

Quick review of convex bodies, Minkowski sum, Brunn-Minkowski inequality and other related volumetric inequalities in convex geometry.

Lecture 2. (2hr)

Functional extensions of the Brunn-Minkowski inequality such as Prekopa-Leindler and Brascamb-Lieb inequalities with applications.

Lecture 3. (2hr)

Introduction to Sobolev type inequalities and their connection to volumetric inequalities for specific families of convex bodies. Affine invariant inequalities and their connection to polar projection and centroid convex bodies.

Lecture 4. (2hr)

Introduction to Log-concave functions and their geometry. Several geometric inequalities extended to the class of Log-concave functions.

Lecture 5. (2hr)

Applications of the previous topics to different areas of Mathematics and Physics.

REFERENCES

- [1] Alonso-Gutiérrez D., Jiménez C.H., Villa R., Brunn-Minkowski and Zhang inequalities for convolution bodies. *Adv. in Math.* **238** (2013), pp. 50–69.
- [2] K. Ball, An elementary introduction to modern convex geometry, in: *Flavors of Geometry*, pp. 1-58, *Math. Sci. Res. Inst. Publ. Vol. 31*, Cambridge Univ. Press, Cambridge, 1997
- [3] Bobkov S. G., Madiman M., The entropy per coordinate of a random vector is highly constrained under convexity conditions. *IEEE Transactions on Information Theory*, **57** (2011), no. 8, pp. 4940–4954.
- [4] S. Brazitikos, A. Giannopoulos, P. Valettas, B. H. Vritsiou, *Geometry of Isotropic Convex Bodies*, *Mathematical Surveys and Monographs 196* American Mathematical Society, Providence, RI., 2014
- [5] Campi, S., Gronchi, P. - *The L_p -Busemann-Petty centroid inequality*. *Adv. Math.* 167 (2002), 128-141.

- [6] D. Cordero-Erausquin, B. Nazaret, C. Villani - *A mass-transportation approach to sharp Sobolev and Gagliardo-Nirenberg inequalities*, Advances in Mathematics, Volume 182, Issue 2, 1 March 2004, Pages 307-332
- [7] J. Haddad, C. H. Jiménez, M. Montenegro, Sharp affine Sobolev type inequalities via the Lp Busemann-Petty centroid inequality, preprint.
- [8] A. Koldobsky, Fourier Analysis in Convex Geometry, Mathematical Surveys and Monographs, 116, American Mathematical Society, Providence, RI., 2005
- [9] Klartag B., Milman V. D., Geometry of log-concave functions and measures. *Geom. Dedicata* **112** (2005), no. 3, pp. 169–182. Lutwak, E., Yang, D., Zhang, G.- *Lp affine isoperimetric inequalities*. *J. Differential Geom.* 56 (2000) 111-132.
- [10] Lutwak, E., Yang, D., Zhang, G.- *Sharp affine Lp Sobolev Inequalities*. *J. Differential Geom.* 62 (2002) 17-38.
- [11] V. D. Milman, G. Schechtman, Asymptotic Theory of Finite Dimensional Normed Spaces, Springer Lecture Notes in Mathematics, 1200, (1986)
- [12] G. Pisier, The Volume of Convex Bodies and Banach Space Geometry, Cambridge University Press, 94, (1989)
- [13] R. Schneider, Convex bodies: the Brunn-Minkowski theory, Cambridge University Press, Cambridge, 1993.
- [14] Zhai, Z. - *Note on Affine Gagliardo-Nirenberg Inequalities*. *Potential Anal* (2011) 1-12.
- [15] Zhang G. - *The affine Sobolev inequality*, *J. Differential geometry* **53** (1999), pp. 183–202.

DEPARTAMENTO DE MATEMÁTICA, UNIVERSIDADE FEDERAL DE MINAS GERAIS
E-mail address: hugo@mat.ufmg.br