

MEAN CURVATURE FLOW- SUMMER SCHOOL “GEOMETRIC FLOWS AND RELATIVITY”

MARIEL SÁEZ

In this course we are going to cover basic topics on Mean Curvature Flow. We will start with a basic introduction on extrinsic geometry and PDE’s and progress as much as possible in the course topics listed below.

There are many books on Mean Curvature Flow and the syllabus is only a selection of them. Background on differential geometry and/or PDE’s is desirable but not strictly necessary.

1. COURSE TOPICS

- Background material in differential geometry and PDE. [3]
- Definition of Mean Curvature Flow and basic examples. [3] [8] [9]
- The maximum principle in MCF and applications. [3] [8] [9]
- Curve Shortening Flow: the Grayson-Gage-Hamilton’s Theorem.[2][7] [1]
- Type I singularities. [3] [8] [9]
- Type II singularities. [3] [8] [9]
- Graphical Mean Curvature flow and some applications.[4], [5] [6]

REFERENCES

- [1] B. Andrews and P. Bryan. Curvature bound for curve shortening flow via distance comparison and a direct proof of Grayson’s theorem. *J. Reine Angew. Math.*, 653:179–187, 2011.
- [2] K.-S. Chou and X.-P. Zhu. *The curve shortening problem*. Chapman & Hall/CRC, Boca Raton, FL, 2001.
- [3] K. Ecker. *Regularity theory for mean curvature flow*, volume 57 of *Progress in Nonlinear Differential Equations and their Applications*. Birkhäuser Boston, Inc., Boston, MA, 2004.
- [4] K. Ecker and G. Huisken. Mean curvature evolution of entire graphs. *Ann. of Math. (2)*, 130(3):453–471, 1989.
- [5] K. Ecker and G. Huisken. Interior estimates for hypersurfaces moving by mean curvature. *Invent. Math.*, 105(3):547–569, 1991.
- [6] L. C. Evans and J. Spruck. Motion of level sets by mean curvature. I. *J. Differential Geom.*, 33(3):635–681, 1991.
- [7] G. Huisken. A distance comparison principle for evolving curves. *Asian J. Math.*, 2(1):127–133, 1998.
- [8] C. Mantegazza. *Lecture notes on mean curvature flow*, volume 290 of *Progress in Mathematics*. Birkhäuser/Springer Basel AG, Basel, 2011.
- [9] X.-P. Zhu. *Lectures on mean curvature flows*, volume 32 of *AMS/IP Studies in Advanced Mathematics*. American Mathematical Society, Providence, RI; International Press, Somerville, MA, 2002.