

Advanced Course in Complex Analysis: Planar Harmonic Univalent Mappings (3 cr), Autumn 2011, II period.

Lecturer: Prof. S. Ponnusamy, IIT Madras, India.

Lectures: Wednesday 10-12 @ U344 (Aalto University, TKK)

Exercises: Wednesday 14-16 @ U344

The first lecture will be on November 2.

Abstract: Planar harmonic, biharmonic and logharmonic mappings will be discussed. The emphasis will be on understanding issues related to planar conformal maps. The series of lectures will include the following topics:

- Introducing planar harmonic mappings, normalized class of univalent harmonic mappings and area minimizing property.
- Harmonic starlike, harmonic close-to-convex, and harmonic convex mappings. Specially, extremal functions and coefficient conjectures and various related issues.
- Criterion for univalent (close-to-convex, starlike, convex) harmonic mappings.
- Harmonic Mappings via "method of Shearing". Specifically, we describe the geometry of mappings produced by the method of shear.
- Introducing Harmonic Bloch constants, and Bloch-Landau's theorems.
- Basic issues about biharmonic mappings, and its various properties.
- Log-harmonic mappings and its various properties in connection with problems related various geometric subclasses.
- Bohr's phenomenon in certain class of harmonic mappings.
- Important recent results on harmonic mappings.

The main reference will be the book by Duren [1]. For some basic materials on harmonic mappings, one can refer to the three articles of the author [2, 3, 4]. A refined version of these together with latest information may be obtained from [5].

References

- [1] P. DUREN, *Harmonic mappings in the plane*, Cambridge University Press, 2004.
- [2] S. PONNUSAMY and A. RASILA, *Planar harmonic mappings*, Ramanujan Math. Soc. Math. Newsletter, 17 (2)(2007), 40–57.
- [3] S. PONNUSAMY and A. RASILA, *Planar harmonic and quasiregular mappings*, Ramanujan Math. Soc. Math. Newsletter 17 (3) (2007), 85–101.
- [4] S. PONNUSAMY, A. RASILA and M. VUORINEN, *Special classes of planar harmonic univalent mappings*, Ramanujan Math. Soc. Math. Newsletter (2009).
- [5] S. PONNUSAMY and A. RASILA, *Planar harmonic and quasiconformal mappings*, in Proc. of a workshop: Computational Methods and Function Theory, To appear.

Prerequisites: Basic complex analysis at the level of the books of Lars Ahlfor's or J.B. Conway or S. Ponnusamy, or S. Ponnusamy and Herb Silverman, together with some knowledge about special class of univalent analytic functions.