

Workshop on Potential Theory and Applications, 2012, Szeged, Hungary
<http://www.math.u-szeged.hu/wspota2012/>

Bergman orthogonal polynomials on archipelago and 2D image reconstruction

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Let G be a finite union of disjoint and bounded Jordan domains in the complex plane, let K be a compact subset of G and consider the set G^* obtained from G by removing K , i.e., $G^* := G \setminus K$. (We call G an archipelago and G^* an archipelago with lakes). Also, let $\{p_n\}_{n=0}^\infty$ and $\{p_n^*\}_{n=0}^\infty$ denote the sequences of the Bergman polynomials of G and G^* , respectively, that is, the orthonormal polynomials with respect to the area measure on G and G^* that have positive leading coefficients. The purpose of the talk is to report on some recent results showing that p_n and p_n^* have comparable asymptotic properties. In other words, the asymptotic properties of the Bergman polynomials on G^* are determined by the outer Jordan curves. This is important, because we can analyze the asymptotic properties of p_n^* , and its zero distribution behavior, by using the corresponding results for p_n , which were obtained in a recent paper by B. Gustafsson, M. Putinar, E.B. Saff and the speaker [GPSS09]. The above lead to a reconstruction algorithm for recovering the shape of an archipelago with lakes, from a partial set of its complex moments.

This is a report of joint work with E.B. Saff, H. Stahl and V. Totik.

References

- [GPSS09] Björn Gustafsson, Mihai Putinar, Edward B. Saff, and Nikos Stylianopoulos. Bergman polynomials on an archipelago: estimates, zeros and shape reconstruction. *Adv. Math.*, 222(4): 1405–1460, 2009. CODEN ADMTA4. ISSN 0001-8708. URL <http://dx.doi.org/10.1016/j.aim.2009.06.010>.