European Research Council

ERC Advanced Grant 2010
Reserch proposal (Part B1)

Potential Theoretic Methods in Approximation and Orthogonal Polynomials

PotentialTheory

Cover Page

- Name of the Principal Investigator (PI): Vilmos Totik

- Name of the PI's host institution for the project: University of Szeged, Hungary

- Proposal full title: Potential Theoretic Methods in Approximation and Orthogonal Polynomials

- Proposal short name: PotentialTheory

- Proposed duration in months: 60

Proposal summary: The project is aimed at systematic applications of potential theoretical methods in approximation theory and in the theory of orthogonal polynomials. Various open problems are mentioned in different areas which can be attacked with tools that have been developed in the near past or are to be developed within the project. In most cases even the formulation of the existing and expected results needs concepts from potential theory. The main topics are
- asymptotic behavior of Christoffel functions with direct applications to the spectral theory of Jacobi operators and to universality questions in random matrix theory,
- orthogonal polynomials with respect to doubling weights; zero spacing and zero location; oscillatory behavior,
- extensions of classical results from the real line or the unit circle to systems of Jordan curves and arcs,
- polynomial inequalities on general sets and inequalities with respect to doubling measures,
- approximation by homogeneous polynomials on convex surfaces, and
- theoretical foundations of the use of Leja points in numerical analysis.

The so called polynomial inverse image method may have a relevance to several of the proposed problems: it transforms results (not proofs!) from model cases like the unit circle or an interval to general sets. The essence is that in the model cases classical tools from harmonic analysis and function theory are available, and, while the proofs cannot be carried over to general sets, the method transforms the result proved in the model case to exact results on other sets.

All the research areas discussed in the proposal are intensively investigated in current research. As has been the case in the past, PhD students will be actively involved in the research.