asymptotics of orthogonal polynomials for a weight with a jump on [-1,+1]

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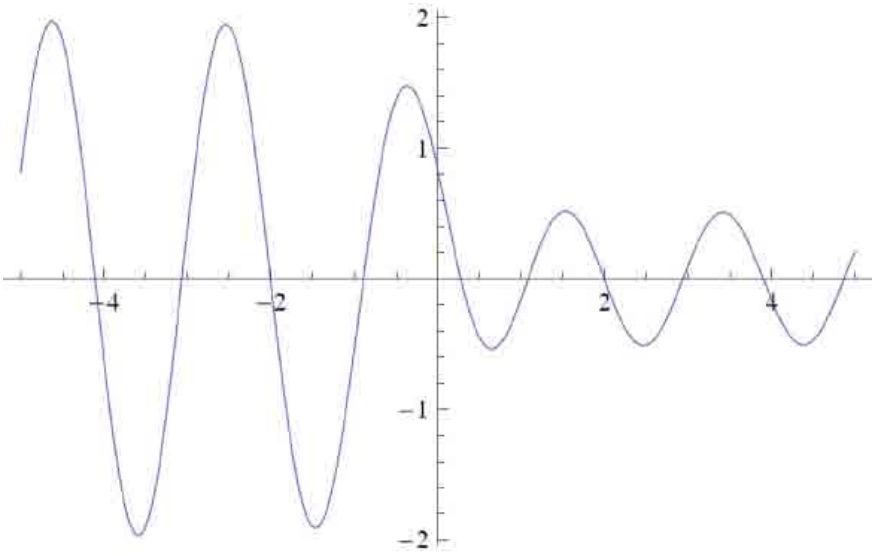


Szegö is the founder of the modern general theory of orthogonal polynomials. In particular, he was the first to prove the crucial asymptotic result for polynomials orthogonal on the interval with respect to weights that satisfy a condition that today bears his name. In the case of the classical Jacobi weights, we can derive this asymptotics (both on and away from the interval of orthogonality, as well as at its endpoints) using several identities that these orthogonal polynomials satisfy: the differential equation, the Rodrigues formula, integral representation, etc. However, in a general situation, the problem is much more difficult. Starting from the 80's, many new asymptotic results were found for various classes of weights, and the breakthrough was partially motivated by the development of the tools from potential theory and operator theory.

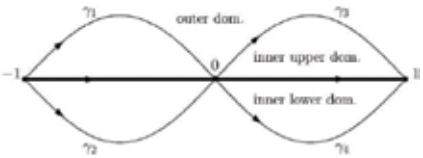
An important new technique for obtaining asymptotics for orthogonal polynomials in all regions of the complex plane is based on the characterization of the orthogonal polynomials by means of a Riemann–Hilbert problem for 2 _ 2 matrix-valued functions due to Fokas, Its, and Kitaev, combined with the steepest descent method of Deift and Zhou.

In a recent paper by Kuijlaars and collaborators, the complete asymptotic expansion for the orthogonal polynomials with respect to a Jacobi weight modified by a real analytic and strictly positive function was obtained. It showed that this modification does not affect essentially the local behavior of the polynomials, which has a direct implication to the study of the so-called universality property and the "clock behavior" (uniform spacing) of the zeros.

A very different situation arises when the weight has a singularity on the interval of orthogonality. The case of a zero was analyzed in the work of Vanlessen, but the case of the jump singularity remained open. We consider polynomials that are orthogonal on a finite interval [_1, 1] with respect to a modified Jacobi weight with a jump at the origin. From our analysis we obtain strong uniform asymptotics of the monic orthogonal polynomials in the whole complex plane, as well as the first terms of the asymptotic expansion of the main parameters (leading coefficients of the orthonormal polynomials and the recurrence coefficients). In particular, we prove a conjecture of A. Magnus regarding the asymptotics of the recurrence coefficients.

The main focus is on the local analysis at the origin that is made using confluent hypergeometric functions. We study the asymptotics of the Christoffel–Darboux kernel in a neighborhood of the jump, and this is the first explicit example of a non-sine reproducing kernel of a de Branges space that arises as a universality limit in the bulk of a fixed measure of orthogonality.

We also show that the zeros of the orthogonal polynomials no longer exhibit the clock behavior.



promotion of students' mobility in europe: an innovative study in a virtual environment

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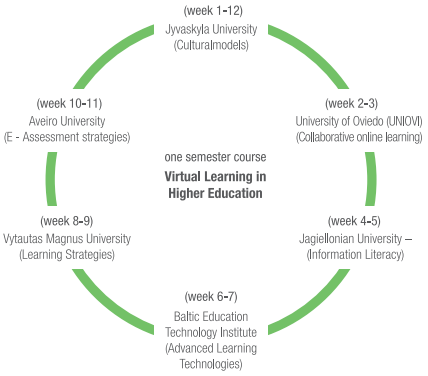
Virtual Learning in Higher Education (VLHE) is the name of a full semester course delivered in a virtual mobility mode. The main particularity of this course is that it was designed, developed, delivered and evaluated by six different European institutions in a fully distance mode using online synchronous and asynchronous tools. The VHLE course (6 ECTS) was delivered in the first semester of 2010/11 in English to thirty students from five different European countries (Finland,



Lithuania, Poland, Portugal and Spain) and was divided in six different, but articulated, modules (one per institution), each one with two weeks duration.
The University of Aveiro (UA), through the Evaluation Quality Laboratory (LAQE) of the CIDTFF, participated as the responsible institution, in a collaborative way, for designing the VLHE course curricula and for planning and delivering the E-Assessment strategies module, the sixth module of the course. The majority of the teaching and learning strategies was based on the use of synchronous and asynchronous communication strategies that were frequently used in live classes, using video conference, or in group discussions using Video-Conferencing, Skype and Google Docs.
Student groups were formed in the beginning of the course, including members from the different partner countries. Students were then engaged in group and individual work and presented the results achieved in the end of each week in a live class. Given the fact that this course was developed in a research context, knowledge has been produced that hopefully may contribute to the extension of this innovative initiative (Teresevi_ien_, Volungeviciene & Dauk_ien_, 2011).
The VLHE course was one outcome of a European Lifelong Learning project, TeaCamp, coordinated by Vytautas Magnus University (Lithuania). TeaCamp aimed to increase mobility, in a virtual environment, by facilitating the development, management and implementation of virtual mobility and research and by improving virtual mobility competences. This main objective is aligned with the European educational policy concerning the need to increase students and staff mobility as a key element for the European Area of Higher Education.
Further information can be found in the TeaCamp website: http://www.teacamp.eu/

CO_2 emission allowances and other fuel markets interaction

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This empirical work examines interactions between carbon, electricity and fossil fuel (coal, oil and natural gas; primary energy prices used in electricity generation) returns. Impacts of emission trading are studied with the Vector Error Autoregressive Correction Model (VECM) approach, for 5 endogenous variables, using monthly data from October 2005 to October 2009, throughout Europe (Germany, France and Nordic countries), by taking into account their heterogeneity. This enabled us to reveal the difference in responses to carbon constraints in the electricity generation sector and to evaluate the efficiency of the EU ETS. Results reveal that nuclear power generation could limit increases in prices of electricity and that the effect of carbon