Mahler measures, short walks and log-sine integrals: A case study in hybrid computation

[Extended Abstract]

Jonathan Borwein
Professor Laureate, Director
Centre for Computer Assisted Research Mathematics and its Applications (CARMA)
School of Mathematical and Physical Sciences
University of Newcastle
Callaghan NSW 2308, Australia
jon.borwein@gmail.com

Categories and Subject Descriptors
G.1.9 [Mathematics of Computing]: Numerical Analysis
Integral Equations; I.1.2 [Computing Methodologies]: Symbolic and algebraic manipulation Algorithms

General Terms
Theory, Experimentation

Keywords
Mahler measures, short walks, log-sine integral

The Mahler measure of a polynomial of several variables has been a subject of much study over the past thirty years. Very few closed forms are proven but many more are conjectured.

We provide systematic evaluations of various higher and multiple Mahler measures using moments of random walks and values of log-sine integrals. We also explore related generating functions for the log-sine integrals and their generalizations.

This work would be impossible without very extensive symbolic and numeric computations. It also makes frequent use of the new NIST Handbook of Mathematical Functions.

My intention is to show off the interplay between numeric and symbolic computing while exploring the three topics in title.