Application of PLSQ to Special Function Values

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Abstract

We are demonstrating how advanced semi-numerical techniques help in reconstructing exact values from numerical evaluation of special functions and definite integrals of such functions. Among the considered special functions are integrals of Airy wave functions and special values of auxiliary elliptic functions that arise as quotients of Jacobi Theta series. Applied techniques include LLL (Lenstra-Lenstra-Lovasz method of finding "short" vectors in integer lattices) and PSLQ (Partial Sum of Least Squares, by Bailey and Ferguson). Both techniques are implemented in Maple's IntegerRelations package, and wrapped into the "identify" command for ease of usage. However, these techniques typically require very high precision and hence substantial computing power. Several examples show the successful application of PSLQ method in particular. Exact results returned by these methods must not be mixed up with proven results, but can serve as a starting point for further investigation.

Keywords: PSLQ, LLL, Special Functions, Minimal Polynomials, Maple, "identify" command