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Multiple orthogonal polynomials, recurrence relations and the corresponding Toda lattice

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Abstract

Multiple orthogonal polynomials are polynomials of one variable which satisfy orthogonality relations with respect to $r \geq 1$ measures (multiple orthogonality). We show that they satisfy a linear recurrence relations on a lattice in \mathbb{Z}^r . These polynomials are bi-orthogonal with respect to another family of functions (Type I versus Type II multiple orthogonal polynomials). Important examples are the multiple Hermite polynomials and multiple Laguerre polynomials, which appear in random matrix theory (with external source). We indicate how one can obtain equations for a Toda lattice in \mathbb{Z}^r .