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Total positivity, M-curves and real regular Kadomtsev-Petviashvili II solutions.

This lecture is based on joint results with Simonetta Abenda, Bologna University.

We establish a bridge between two approaches to constructing real regular solutions of the Kadomtsev-Petviashvili equation. Multiline soliton solutions are constructed in terms of totally non-negative Grassmannians, and real regular finite-gap solution correspond to spectral M-curves with divisors satisfying an extra condition. It is easy to construct soliton solutions by degenerating the spectral curves, but if we would like to stay in the real regular class, the problem becomes non-trivial.

We present a construction associating a degenerate M-curve and a divisor on it with reality and regularity condition to a point of a totally non-negative Grassmannian. This construction essentially uses the parametrization of the totally non-negative Grassmannians in terms of the Le-networks from the Postnikov's paper.