# Integrable eigenvalue algorithms for totally nonnegative matrices

**Akiko Fukuda**

*Department of Mathematical Sciences,*
*Shibaura Institute of Technology, Japan*

**Abstract**

There are interesting relationships between eigenvalue algorithms and integrable systems. Integrable systems are nonlinear differential or difference equations which can be solved exactly. Based on the integrable discrete hungry Toda molecule equation, we have designed an algorithm for computing eigenvalues of a class of totally nonnegative matrices [1]. This algorithm can be regarded as a generalization of the dqds algorithm. In this talk, we focus on the discrete two-dimensional Toda molecule (d2Toda) equation, which is a generalization of the discrete hungry Toda molecule equation. We show that the d2Toda equation can be applied to compute eigenvalues of a class of totally nonnegative (TN) matrices. Through discrete time evolution of the d2Toda equation, the d2Toda variables yield the eigenvalues of the TN matrix. The resulting algorithm can be regarded as an extension of the qd algorithm. We also show the relationship between another integrable system and TN matrices, and computation of the eigenvector of the TN matrices.

## References

[1] Akiko Fukuda, Emiko Ishiwata, Yusaku Yamamoto, Masashi Iwasaki, Yoshimasa Nakamura, Integrable discrete hungry systems and their related matrix eigenvalues, Annal. Mat. Pura Appl., 192 (2013), 423–445.