

The Hodge theory of multidimensional Delsarte
transmutation differential operators and its application
in nonlinear integrable dynamical systems
Anatoliy K. Prykarpatsky*), Denis L. Blackmore**), Yarema A.
Prykarpatsky**)***)

*) *Dept. of Applied Mathematics at the AMM-University of Science and Technology, 30 Mickiewicz Al. Bl. A4, 30059 Krakow, Poland and Dept. of Nonlinear Math. Analysis at the Institute of APMM of the Nat. Acad. of Sciences, Lviv, 79601 (email: prykanat@cyberagl.com, pryk.anat@ua.fm)*

**) Dept. of Mathematical Sciences at the NJIT, Newark, NJ 07102, USA

***) Brookhaven National Lab., Upton, NY, USA

ABSTRACT. The Hodge theory of multidimensional Delsarte-Darboux transmutation operators in parametric functional spaces is studied by means of differential-geometric and topological tools. It is shown that kernels of the corresponding integral operator expressions depend on the topological structure of related homological cycles in the coordinate space. As a natural realization of the construction presented we build pairs of Lax type commutative differential operator expressions (see [1, 2, 4, 5]) related via a Delsarte-Darboux transformations [3] and having a lot of applications in spectral and soliton theories.

References

- [1] Nizhnik L.P. *Inverse scattering problems for hyperbolic equations*. Kiev, Nauk. Dumka Publ., 1991 (in Russian)
- [2] Samoilenko A.M., Prykarpatsky Y.A. and Samoilenko V.G. The structure of Darboux-type binary transformations and their applications in soliton theory. *Ukr. Mat. Zhurnal*, 2003, v. 55, N12, p.1704-1723 (in Ukrainian)
- [3] Matveev V.B. and Salle M.I. *Darboux-Backlund transformations and applications*. NY, Springer, 1993.
- [4] Prykarpatsky A.K., Samoilenko A.M. and Prykarpatsky Y.A. The multi-dimensional Delsarte transmutation operators, their differential-geometric structure and applications. Part.1. *Opuscula Mathematica*, 2003, v. 23, p.71-80
- [5] Samoilenko A.M. and Prykarpatsky Y.A. *Algebraic-analytic aspects of completely integrable dynamical systems and their perturbations*. Kyiv, NAS, Inst. Mathem. Publisher, 2002, v.41. (in Ukrainian)