Skew-selfadjoint Dirac systems with a rational Weyl function: direct and inverse problems, and related nonlinear equations

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In this talk we deal with skew-selfadjoint differential systems of Dirac type, continuous or discrete time, and in both cases the Weyl function is assumed to be a rational matrix function. This allows one to use state space techniques from mathematical system and control theory to solve explicitly various direct and inverse problems, and to obtain explicit solutions for a number of classical non-linear PDEs. The latter appear when the corresponding pseudo-canonical potential depends on an additional second variable. We shall review some of the earlier results for the continuous time case derived in joint work with the late Israel Gohberg and Alexander Sakhnovich [1]. In the second part of the talk the emphasis will be on the discrete time setting. In this case, using state space techniques, explicit solutions are obtained for the so-called generalized discrete Heisenberg magnet model. This part of the talk is based on recent joint work [2], [3] with Bernd Fritzsche, Bernd Kirstein, and Alexander Sakhnovich.

References:

[1] I. Gohberg, M.A.Kaashoek, and A.L.Sakhnovich, Pseudocanonical systems with rational Weyl functions: explicit formulas and applications, *Journal Diff. Eq.* **146** (1998), 375-398.

[2] M.A. Kaashoek and A.L. Sakhnovich, Discrete skew self-adjoint canonical system and the isotropic Heisenberg magnet model. *J. Funct. Anal.*, **228** (2005), 207–233.

[3] B. Fritzsche, M.A. Kaashoek, B. Kirstein, and A.L. Sakhnovich, Discrete and continuous skew-self-adjoint Dirac systems: rational rectangular Weyl functions and explicit solutions of direct and inverse problems, arXive 1501.00395.