Report on PhD Thesis

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Thesis: Recursion operators, nonlocal symmetries and related structures for some integrable systems

The thesis is devoted to an actual and important direction in the study of integrable partial differential equations based on the concept of recursion operators for symmetries and cosymmetries. As the object of the research presented in the thesis the author takes the Mikhailov–Novikov–Wang equation and the Krichever–Novikov equation. In his work he uses the approach to the recursion operators proposed by G.A. Guthrie and developed in the works of M. Marvan and A. Sergyeyev. This approach treats recursion operators as Bäcklund autotransformations of the tangent or cotangent coverings over the initial equation. The author convincingly demonstrates the fruitfulness of the approach in question by solving with its help two difficult and challenging problems: finding the recursion operator for the Mikhailov–Novikov–Wang equation and the inversion of the fourth-order recursion operator for the Krichever–Novikov equation. Then he uses the said recursion operator for constructing infinitely many compatible Hamiltonian and symplectic structures together with infinite hierarchies of local higher symmetries and conservation laws for the Mikhailov–Novikov–Wang equation. For the Krichever–Novikov equation the author constructs new infinite hierarchies of shadows of nonlocal symmetries and cosymmetries using the above inverse recursion operator and its formal adjoint.

The thesis consists of 6 chapters and the list of references. The introduction contains a brief history of the previous studies and the statements of research problems addressed in the thesis. Chapters 2, 3 and 4 are devoted to a brief exposition of the basic concepts of geometry of differential equations. Chapters 5 and 6 are based on author's papers published in *Physics Letters A* and *Journal of Mathematical Physics*. They present the results of his research.

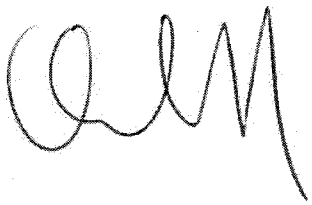
The thesis is written in a clear style. I have just a few remarks on the text.

1) I didn't find the definition of the quantity $\mathbf{v}_F = (\pi_{\infty,0})_* \mathbf{E}_F$ (Definition 4, page 19) neither in [KV] nor in [BV]. This differential operator does not appear neither in the following text of the thesis nor in the papers [1] and [2]. Perhaps this definition could be omitted.
2) I think that the numerous references to monographs should be made more precise, specifying their chapters, sections, or pages.
3) In diagram (19) and the diagram on page 25 the upper-left π should be replaced by $\tilde{\tau}_1$, while the lower π's should be replaced by τ.

4) It is not clear what is $\mathcal{P}_0$ in the formula at the middle of page 27.

These minor shortcomings do not affect the overall positive assessment of the thesis.

The results of the thesis are interesting, new and correct. The author has shown his ability of creative mathematical work. I suggest to award the Ph.D. degree to Petr Vojčák.



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