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Lie Algebras Associated with Group U(n)

ZHANG Yu-Feng,[1] DONG Huang-He,[2] and Honwah Tam[3]

[1] Mathematical School, Liaoning Normal University, Dalian 116029, China
[2] School of Information and Science Engineering, Shandong University of Science and Technology, Qingdao 266510, China
[3] Department of Computer Science, Hong Kong Baptist University, Hong Kong, China
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Abstract: Starting from the subgroups of the group U(n), the corresponding Lie algebras of the Lie algebra A_1 are presented, from which two well-known simple equivalent matrix Lie algebras are given. It follows that a few expanding Lie algebras are obtained by enlarging matrices. Some of them can be devoted to producing double integrable couplings of the soliton hierarchies of nonlinear evolution equations. Others can be used to generate integrable couplings involving more potential functions. The above Lie algebras are classified into two types. Only one type can generate the integrable couplings, whose Hamiltonian structure could be obtained by use of the quadratic-form identity. In addition, one condition on searching for integrable couplings is improved such that more useful Lie algebras are enlightened to engender. Then two explicit examples are shown to illustrate the applications of the Lie algebras. Finally, with the help of closed cycling operation relations, another way of producing higher-dimensional Lie algebras is given.

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