

A new way to derive the Rodrigues formula for the Lorentz group

DORIN ANDRICA and RAMONA-ANDREEA ROHAN

ABSTRACT.

Using the system (1.4) in Theorem 1.1, we present in Section 3 a new way to derive the Rodrigues formula for the exponential map of the Lorentz group $\mathbf{SO}(3, 1)$.

Acknowledgements. The second author was supported by the following program.

Investing in people! Ph. D. scholarship, Project co-financed by the SECTORAL OPERATIONAL PROGRAM FOR HUMAN RESOURCES DEVELOPMENT 2007 - 2013. Priority Axis 1. "Education and training in support for growth and development of a knowledge based society". Key area of intervention 1.5: Doctoral and post-doctoral programs in support of research. Contract nr. : POSDRU/88/1.5/S/60185 – "INNOVATIVE DOCTORAL STUDIES IN A KNOWLEDGE BASED SOCIETY". Babeş-Bolyai University, Cluj-Napoca, Romania

REFERENCES

- [1] Andrica, D. and Casu, I. N., *Lie Groups, Exponential Map, and Geometric Mechanics* (Romanian), Cluj University Press, 2008
- [2] Andrica, D. and Rohan, R.-A., The image of the exponential map and some applications, *Proc. 8th Joint Conference on Mathematics and Computer Science MaCS*, Komarno, Slovakia, July 14–17, 2010, 3-14
- [3] Andrica, D. and Rohan, R.-A., *Computing the Rodrigues coefficients of the exponential map of the Lie groups of matrices*, *Balkan Journal of Geometry and Applications*, **18** (2013), No. 2, 1–10
- [4] Bröcker, T. and Tom Dieck, T., *Representations of compact Lie groups*, Springer-Verlag, GTM, vol. **98**, New York, 1985
- [5] Chevalley, C., *Theory of Lie groups I*, Princeton Mathematical Series, No. 8, Princeton University Press, 1946
- [6] Chin, S. A., *Relativistic motion in a constant electromagnetic field*, *J. Math. Phys.*, vol. **50**, 012904 (2009), 1–7
- [7] Dimitrov, G. K. and Mladenov, I. M., A new formula for the exponents of the generators for the Lorentz group, *7th International Conference on Geometry, Intergrability and Quantization*, June 2-10, 2005, Varna, Bulgaria, (I. M. Mladenov and M. de León Eds.), 96–113
- [8] Gallier, J., *Notes on Differential Geometry and Lie Groups*, University of Pennsylvania, 2012
- [9] Marsden, J. E. and Ratiu, T. S., *Introduction to Mechanics and Symmetry*, TAM, vol. **17**, Springer-Verlag, 1994
- [10] Putzer, E. J., *Avoiding the Jordan canonical form in the discussion of linear systems with constant coefficients*, *Amer. Math. Monthly*, **73** (1966), 2–7
- [11] Silva Leite, F. and Crouch, P., *Closed forms for the exponential mapping on matrix Lie groups based on Putzer's method*, *J. Math. Phys.*, **40** (1999), No. 7, 3561–3568
- [12] Warner, F., *Foundations of Differential Manifolds and Lie Groups*, GTM, No. 94, Springer-Verlag, 1983

Received: 10.11.2012; In revised form: 14.02.2013; Accepted: 16.02.2013

2010 *Mathematics Subject Classification*. 22Exx, 22E60, 22E70.

Key words and phrases. *Lie group, Lie algebra, exponential map, general linear group $\mathbf{GL}(n, \mathbb{R})$, Lorentz group $\mathbf{SO}(3, 1)$, Rodrigues formula, Rodrigues coefficients.*

Corresponding author: Dorin Andrica; dandrica@math.ubbcluj.ro

BABEȘ-BOLYAI UNIVERSITY
FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
CLUJ-NAPOCA, ROMANIA
E-mail address: dandrica@math.ubbcluj.ro

BABEȘ-BOLYAI UNIVERSITY
FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
CLUJ-NAPOCA, ROMANIA
E-mail address: ramona.rohan@ubbcluj.ro