NEW PARAMETERIZATIONS OF $\mathrm{SL}(2, \mathbb{R})$ AND SOME EXPLICIT FORMULAS FOR ITS LOGARITHM

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Abstract. Here we demonstrate some of the benefits of a novel parameterization of the Lie groups $\mathrm{Sp}(2, \mathbb{R}) \cong \mathrm{SL}(2, \mathbb{R})$. Relying on the properties of the exponential map $\mathfrak{sl}(2, \mathbb{R}) \to \mathrm{SL}(2, \mathbb{R})$, we have found a few explicit formulas for the logarithm of the matrices in these groups.

Additionally, the explicit analytic description of the ellipse representing their field of values is derived and this allows a direct graphical identification of various types.

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Contents

1. Introduction

Lie groups and Lie algebras play an essential role in many areas of mathematical physics and mathematics applications, see, e.g., [5, 6, 8–10, 12, 14–16]. One of the most interesting class of the classical Lie groups is that one of the symplectic