REMARKS ON POISSON REDUCTION ON $k$-SYMPLECTIC MANIFOLDS

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Abstract. Two reduced standard $k$-symplectic Poisson manifolds with respect to the action of a Lie group $G$ are considered, and the relation between the corresponding Poisson structures is established.

1. Introduction

Starting with a Poisson manifold, one can construct by reduction other Poisson manifolds. This procedure is well known and important in the symplectic mechanics having applications in fluids [5], electromagnetism and plasma physics [4], etc. Let us mention also that Juan-Pablo Ortega and Tudor Răţiu [7] described the Poisson reduction specifying the assumptions under that a Poisson manifold could be reduced to a Poisson manifold, too.

In what follows we shall present the Poisson reduction in the case of the standard $k$-symplectic manifold $(T^1_k \mathbb{R}^n)^* \mathbb{R}^n$ with the canonical $k$-symplectic structure induced from $(\mathbb{R}^n, \omega_0)$ [1]. Then, using a diffeomorphism, we can endow $T^1_k \mathbb{R}^n$ with a $k$-symplectic structure that will be reduced, too (the two manifolds $T^1_k \mathbb{R}^n = T \mathbb{R}^n \oplus \cdots \oplus T \mathbb{R}^n$ and respectively $(T^1_k)^* \mathbb{R}^n = T^* \mathbb{R}^n \oplus \cdots \oplus T^* \mathbb{R}^n$ will be identified with the Whitney sum of $k$-copies of $T \mathbb{R}^n$ and respectively of $T^* \mathbb{R}^n$ [6]). Finally, we shall discuss the relation between the two induced Poisson structures on the reduced manifolds.

In order to do this, we consider an appropriate action of a Lie group $G$ on the two manifolds. Such canonical actions can be obtained, for instance, by lifting an arbitrary action of $G$ on $\mathbb{R}^n$ to $(T^1_k)^* \mathbb{R}^n$ and $T^1_k \mathbb{R}^n$ respectively.