NORMAL FORM OF REVERSIBLE-EQUIVARIANT VECTOR FIELDS

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In a dynamical system, the presence of symmetries or reversing symmetries leads to the occurrence of multiple solutions: symmetries take trajectories in trajectories, preserving the direction with time, whereas reversing symmetries take trajectories in trajectories, reversing direction with time. When both occur simultaneously, the system is called reversible-equivariant and all these objects have structure of group, the group of symmetries and reversing symmetries of the system, denoted by Γ. This fact implies the existence of a normal subgroup of index 2, formed by symmetries of Γ and denoted by Γ_+. Thus, the mathematical formulation for this theory is made through the group representation theory. The study begins by considering a group homomorphism

$$\sigma : \Gamma \to \mathbf{Z}_2, \tag{1}$$

where $\mathbf{Z}_2$ is the multiplicative group $\{-1, 1\}$ e $\Gamma_+ = \ker(\sigma)$. A vector field $g : V \to V$ is called Γ-reversible-equivariant if

$$g(\gamma x) = \sigma(\gamma)\gamma g(x),\ \forall \gamma \in \Gamma,\ x \in V. \tag{2}$$

In the study of various dynamic phenomena, a method of great interest is to pass the vector field for the normal form Belitskii. In fact, this has been a very efficient tool for the study of bifurcations, the occurrence of periodic solutions, limit cycles and other local and global phenomena. In this work, we deduce how to obtain this normal form preserving all symmetries and reversing symmetries of system. The method is based on the representation theory of algebraic groups and invariant theory.

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