

ABSTRACT

In the following *thesis*, we describe structures equipped with a group action, by automorphisms, of a fixed group G . More precisely, for an \mathcal{L} -theory T , we introduce the theory T_G in the language \mathcal{L} expanded by unary function symbols $(\sigma_g)_{g \in G}$, such that models of T_G are exactly models of the theory T equipped with group action of the group G by automorphisms $(\sigma_g)_{g \in G}$.

Working under the assumption that T has the model companion T^{mc} such that T^{mc} eliminates quantifiers and imaginaries, we analyse, using the generalized Galois theory, \mathcal{L} -substructures of models of the theory T^{mc} equipped with group action of the group G . Afterwards, we use the previous analysis to achieve a description of models of the model companion (if such exists) of the theory T_G , denoted by T_G^{mc} , as substructures of models of the theory T^{mc} . Main results of the *thesis* are obtained under the assumption of stability of the theory T^{mc} . The most important is the following implication (written without some details)

if the theory T^{mc} is stable, then the theory T_G^{mc} is simple.

Moreover, in the *thesis* it has been shown that if the theory T^{mc} is stable, then the theory T_G^{mc} has the geometric elimination of imaginaries, its models are pseudo-algebraically closed structures and a characterization of the algebraic closure operator for the theory T_G^{mc} has been provided, as well as a characterization of the forking independence. The proofs are based on the introduced in the *thesis* notion of model theoretic *regular extensions* and on the generalized in the *thesis* notion of *pseudo-algebraically closed structures*.

Beside of several basic examples given in the *thesis*, in the last chapter, we analysed an example of a theory with a group action of the group G . Explicitly, the theory of existentially closed fields with a finite group action. This example shows how the previously obtained, theoretical, results, can be applied to a very natural mathematical theory. A significant theorem in this context is a statement saying that the model companion of the theory of fields with finite group action exists.

In the *thesis*, we also undertook a description of the invariants of a group action of the group G on models of the theory T_G^{mc} . After assuming that G is finitely generated, it has been shown that the structure of invariants is pseudo-algebraically closed and has a small Galois group, and its theory is a simple theory.