

ABSTRACT

TULCZYJEW'S CONSTRUCTION OF LEGENDRE TRANSFORMATIONS

Mechanics has two main points of view, Lagrangian mechanics and Hamiltonian mechanics. Transformations between Lagrangian mechanics and Hamiltonian mechanics are called Legendre transformations. In this thesis, it is aimed to give a general definition of the Legendre transformations and to construct a geometric structure for these transformations. This thesis is based on Tulczyjew's paper "*The Legendre Transformations*". This geometric construction makes Legendre transformations possible without satisfying one of the most important conditions of classical approach, the Hessian condition.

In the thesis, dynamics are represented by Lagrangian submanifolds. In general, Lagrangian submanifolds are generated by generating functions, but in the thesis, concepts of generating objects are used instead of generating functions to widen the application area. A Lagrangian submanifold can be produced by two different generating objects. In the light of this fact, Hamilton and Lagrange systems are defined as the generating objects, which produce the same Lagrangian submanifold, in other words, same dynamics. It is possible to construct another generating object from a given generating object, which produces the same dynamics. In the thesis, this construction is called Legendre transformation and some examples for various areas of mechanics are provided.