## ABSTRACT

The main result of this thesis is a classification of all homogeneous spaces $G/H$ admitting a $G$-invariant $G_2$-structure, assuming that $G$ is a connected compact Lie group and $G$ acts effectively on $G/H$. They include a subclass of all homogeneous spaces $G/H$ with a $G$-invariant $\tilde{G}_2$-structure, where $G$ is a compact Lie group. There are many new examples with nontrivial fundamental group. A formula computing the dimension of the space of $G$-invariant structures (resp. of $G$-invariant $G_2$-structures) on $G/H$ is given. We study a subclass of homogeneous spaces of high rigidity and low rigidity and show that they admit families of invariant co-closed $G_2$-structures (resp. $\tilde{G}_2$-structures). Some new interesting examples of $\tilde{G}_2$-structures on these spaces are found. We also present a scheme of classification of $\tilde{G}_2$-structures using their intrinsic torsion.