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| **Thesis Title** | *Construction of spacetimes admitting one irreducible second rank Killing tensor* |
| **Supervisor** | T. Christodoulakis, Associate Professor |
| **Summary** | The spacetime geometry is the key ingredient for describing gravity according to general relativity. The dynamic evolution of the metric is governed by Einstein's equations, a set of non-linear partial differential equations. Needless to say, finding the general solution is extremely difficult.<br>An elegant way of simplifying these equations is based upon the use of symmetries. Usually these are symmetries which are related to the homogeneity and isotropy of the spacetime. The infinitesimal generators of those symmetries are called Killing vectors or first rank Killing tensors. However there are higher symmetries which can be used: the corresponding infinitesimal generators are called irreducible Killing tensors of second or higher rank. The use of such kind of symmetries is the main purpose of this work.<br>Therefore, in this thesis we demand the existence of three Killing vectors and one irreducible second rank Killing tensor, which are imposed on the metric, thus arriving at a simplified geometry.<br>It turns out that there exist four classes of metrics satisfying the above demands, for which we search for both vacuum and non-vacuum solutions.<br>The results obtained is firstly that there are no vacuum solutions for none of the simplified metrics.<br>When it comes to the case of non-vacuum solutions we use the (1+3) decomposition in order to study the physical properties of Einstein tensor, perceived as an effective energy momentum tensor.<br>The outcome of this investigation is that there are non-vacuum solutions for all classes. One of the solutions corresponds to an inhomogeneous FRLW cosmological model. |
| **Key words** | Killing tensor, Symmetries, Metric, Einstein equations, Inhomogeneous FRLW |
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