

Calculation of scalars obtained from the Riemann curvature tensor in coordinate components is not always efficient, this is true even in very simple spacetimes. Firstly, the calculation is not intuitive and secondly, many terms involved in such calculations tend to strongly diverge for example on black hole horizons, even though they should precisely “cancel out”. Motivated by [1], main focus of this thesis are circular space times and introduction of 2+1+1 decomposition. The latter allows for rewriting curvature scalar using sectional curvatures, exterior curvatures and geometrically significant timelike congruences. Crucial part of this thesis is software implementation and verification of this approach in Wolfram Mathematica using xAct package.