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# Killing tensors in stationary and axially symmetric space-times

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## Abstract

We discuss the existence of Killing tensors for certain (physically motivated) stationary and axially symmetric vacuum space-times. We show nonexistence of a nontrivial Killing tensor for a Tomimatsu-Sato metric (up to valence 7), for a C-metric (up to valence 9) and for a Zipoy-Voorhees metric (up to valence 11).

The results are obtained by mathematically completely rigorous, nontrivial computer algebra computations with a huge number of equations involved in the problem.

## 1 Introduction

Let  $(M, g)$  be a 4-dimensional manifold with Lorentzian metric  $g$  of signature  $(+, +, +, -)$ . A *Killing tensor* of valence  $d$  on  $M$  is a symmetric tensor field  $K$  whose symmetrized covariant derivative vanishes,

$$\nabla_{(j} K_{i_1 \dots i_d)} = 0. \quad (1)$$

Here,  $\nabla$  denotes the Levi-Civita connection of  $g$  and the components  $K_{i_1 \dots i_d}$  smoothly depend on the position coordinates.

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