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# CLASSIFICATION OF THE SECOND ORDER LINEAR DIFFERENTIAL OPERATORS AND DIFFERENTIAL EQUATIONS

VALENTIN LYCHAGIN AND VALERIY YUMAGUZHIN

ABSTRACT. In this paper we study differential invariants and give a local classification of the second order linear differential operators, acting in sections of line bundles, and a local classification of corresponding differential equations.

## 1. INTRODUCTION

In this paper we consider a local classification of the second order linear differential operators acting in sections of line bundles over an oriented manifold  $M$  and corresponding differential equations.

Possibly Riemann ([11]) was the first who analyzed this problem and found curvature as an obstruction to transform differential operators of the second order to operators with constant coefficients.

In dimension two Laplace ([7]) found "Laplace invariants" which are relative invariants of subgroup of rescaling transformations of unknown functions and Ovsyannikov ([10]) found the corresponding invariants.

All invariants for hyperbolic equations in dimension two with respect to pseudogroup transformations included also diffeomorphisms of the base manifold were found by Ibragimov ([2]).

It worth to note that for the case of ordinary differential operators was done by Kamran and Olver ([3]) and for the case of linear ordinary differential equations of any order relative invariants were found by Wilczynski ([14]).

In this paper we study invariants and classification of linear differential operators and equations in dimension of the base manifold more then two but many results and constructions are applicable in low dimensions also.

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