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SUEZ CANAL UNIVERSITY

ON THE PAINLEVE PROPERTY FOR A CLASS OF DIFFERENTIAL EQUATIONS OF HYPERBOLIC TYPE

by

TAHA HUSSEIN EL-GHAREEB YOUSIF

A thesis

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TO MY PARENTS
AND MY FAMILY

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ABSTRACT

Abstract

The present work discusses the Painleve Property for a class of nonlinear partial differential equation of hyperbolic type with variable coefficients. These coefficients are known to have a physical application in the propagation of surface waves in straits or channels with varying depth and width. It is shown that the constraints which the variable coefficient functions must satisfy for the general class equation to pass the Painleve tests for complete integrability are precisely the same as those in order that the equation may be transformed into the Korteweg de Vries equation, which is known to be completely integrable. The original equation for this class is well known Korteweg de Vries (KdV) equation.

The present thesis focussed on studying the solitary waves, conservation laws and the Backlund transformations for the KdV equation and the general class equation in the literature.

The thesis attempts to study, as well, the Painleve property for the general class seeking solutions of the general class equation in a generalized laurent series, by substitution by the laurent series in the general class equation. The resonances and recursion relation are obtained. At the resonances, the compatibility conditions are obtained, when the Laurent series is a single valued and there exist finite number of arbitrary functions, then the Painleve property is satisfied. The Backlund transformation is obtained by truncating the Laurent series after the constant level term. We obtained the Backlund transformation when the Painleve property is satisfied for two special cases from the general class.

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