



# The Jacobi Elliptic Method and Its Applications to the Generalized Form of the Phi-Four Equation

R.B. Djob<sup>1\*</sup>, E. Tala-Tebue<sup>1</sup>, A. Kenfack-Jiotsa<sup>2</sup> and T.C. Kofane<sup>1</sup>

<sup>1</sup> *Laboratory of Mechanics, Department of Physics, Faculty of Science, University of Yaoundé 1, P.O. Box 812, Yaoundé, Cameroon*

<sup>2</sup> *Nonlinear Physics and Complex Systems Group, Department of Physics, The Higher Teachers' Training College, University of Yaoundé I, P.O. Box 47 Yaoundé, Cameroon*

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**Abstract:** In order to investigate the generalized periodic solutions of the generalized phi-four equation, we use the Jacobi elliptic functions. Many kinds of solutions are obtained. For some parameters, these envelope periodic solutions can degenerate to the envelope shock wave solutions (dark solitons) and the envelope solitary wave solutions (bright solitons). The existence of these solutions is determined by the parameters of the initial equation. The solutions found in this work can be used in many areas of physics such as telecommunications.

**Keywords:** *generalized periodic solutions, generalized phi-four equation; Jacobi elliptic functions; envelope periodic solutions.*

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## 1 Introduction

Before the discovery of solitons, scientists had taken the nonlinear terms in an equation as perturbations. The history of solitons (the wave of translation), in fact, dates back to 1834, the year in which John Scott Russell observed that a heap of water in a canal propagated undistorted over several kilometers. The results obtained in the linear theory of waves, by ignoring the nonlinear parts, are most frequently too far from reality to be useful. The transition from linear to nonlinear description is justified by the necessity to take into account all the details of the observed phenomena. The wave of translation was regarded as a curiosity until the 1960s, when scientists began to use computers to study nonlinear wave propagation. The discovery of mathematical solutions started

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\* Corresponding author: <mailto:rogerdjjob@yahoo.fr>