Analytic bounded travelling wave solutions of some nonlinear equations [☆]

Eugenia N. Petropoulou [a,*], Panayiotis D. Siafarikas [b]

[a] *Department of Engineering Sciences, Division of Applied Mathematics and Mechanics, University of Patras, 26500 Patras, Greece*
[b] *Department of Mathematics, University of Patras, 26500 Patras, Greece*

Abstract

By use of a functional analytic method it is proved that a general class of second order nonlinear differential equations has analytic bounded solution of the form $g(\xi) = \sum_{n=1}^{\infty} A_n (\frac{\xi}{T})^{n-1}$, $|\xi| < T$, $T > 0$. Such a solution is determined in a unique way, once the initial values $g(0)$ and $g'(0)$ are given, by a recurrence relation that the coefficients A_n satisfy. This general class includes the Lienard equation as well as an equation related to the Burgers–KdV equation, both of which are derived when seeking travelling wave solutions of the corresponding partial differential equations. By the method used in this paper all the solutions of these two equations that were found in two recent papers, are also derived here. Moreover, it is proved that they are analytic, absolutely convergent and a bound for each one of them is provided.