EXACT SOLUTIONS OF BOUSSINESQ EQUATION

M. A. JAFARIZADEH∗†‡, A. R. ESFANDYARI∗† and M. MOSLEHI-FARD∗†

∗ Department of Theoretical Physics and Astrophysics, Tabriz University
51664 Tabriz, Iran
† Institute for Studies in Theoretical Physics and Mathematics
19395-1795 Tehran, Iran
‡ Pure and Applied Science Research Center
51664 Tabriz, Iran

Abstract. By considering the Boussinesq equation as a zero curva-
ture representation of some third order linear differential equation and
factorizing this linear differential equation, the hierarchy of solutions
of Boussinesq equation has been obtained from the eigen spectrum of
constant potentials.

1. Introduction

Integrable systems of nonlinear partial differential equations are among the
central and fundamental problems of physics and mathematical physics, con-
sequently they have attracted much interest both in theoretical physics and
mathematics. They have numerous applications in many different branches of
physics and at the same time they show a rich mathematical structure. These
structures include Lax pairs, Miura maps, Bäcklund transformations, infinitely
many local conservation laws and applicability of inverse scattering methods
[4–6,16].

Here we are concerned with Boussinesq equation [4, 7], which describes one-
dimensional weakly nonlinear dispersive water waves [6,10]. The Boussinesq
equation has also a wide application in different branches of physics. For exam-
pies it can appear as a special limit of unelastic magnetohydrodynamic equations
for modeling solar and stellar convection zones [17,18], the electromagnetic
field in dispersive nonlinear dielectrics is governed by a Boussinesq equation
that has solitary solutions [26] and it can be appropriate for the propagation of