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Reversible System Solitary Waye

Background Normal Forms

Bilinear

Literature Revie

Travelling Wave

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GPC MS

Solitary Wave Families in Two Non-Integrable Models Using Reversible Systems Theory

Jonathan Leto

Reversible System Solitary Wa

Background Normal Forms

Normal Forms
Bilinear
Functions

Literature Revie

GPC

Travelling Wave

Travelling Wave

Haveling vva

GPC MS

Overview

- Definitions
- Background
- Literature Review
- Method of Solution
- The Generalized Pochammer-Chree Equations
- A Generalized Microstructure Equation

Overview

Reversible

System Solitary Wa

Normal Forms

Normal Form

Functions

Literature Revi

CDC

Travelling Wave

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Travelling Wave

GPC

Reversible Dynamical System (looss & Adelmeyer)

Consider

$$\frac{dz}{dt} = F(z; \mu), z \in \mathbb{R}^n, \mu \in \mathbb{R}$$
 (1)

where

$$F\left(0;0\right) =0$$

. If there exits a unitary map

$$S: \mathbb{R}^n \mapsto \mathbb{R}^n, S \neq I$$

such that

$$F(Sz; \mu) = -SF(z; \mu)$$

for all z and μ then (1) is a reversible system.

Overview

Definitions

System

Solitary Wave

Normal Forms
Bilinear

Bilinear Functions

Literatur

CDC

Travelling Wave

140

Travelling Wave

Results GPC MS Families of Solitary Waves

Here we will use the term solitary wave or "solitons" in the broadest sense, as a solution to a nonlinear equation which ETC

Overview

Reversible

Solitary Wa

Rackground

Normal Forms

Bilinear

GPC

Travelling Wave

MS

Travelling Wave

Result

MS

Normal Form Theory

Overview

Reversible System

Solitary Wa

Background

Normal Forms

Bilinear

Functions

Literature Revie

CDC

Travelling Wave

MC

Travelling Wave

Results

MS

Properties of Bilinear Functions

Overview

Reversible System

Solitary Wa

Backgroun

Normal Forms

Bilinear

Literature Review

CDC

Travelling Wave

MS

Travelling Wave

Results

GPC MS

Selected Literature Review

Overview

Definition

System

Dankanana

Normal Forms

Bilinear

Lunctions

Literature Revi

GPC

Travelling Wave

MS

Travelling Wave

Results GPC MS

The Generalized Pochammer-Chree Equations

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$$(u - u_{xx})_{tt} - (a_1u + a_2u^2 + a_3u^3)_{xx} = 0$$
 (2)

• GPC2

$$(u - u_{xx})_{tt} - (a_1 u + a_3 u^3 + a_5 u^5)_{xx} = 0$$
 (3)

GPC MS

Travelling Wave ODE

Let z=x-ct and $u(x,t)=\phi(z)$ to reduce (2) and (3) to the Travelling Wave ODE

$$\phi_{zzzz} - q\phi_{zz} + p\phi = \mathcal{N}_{1,2}[\phi] \tag{4}$$

where

$$\mathcal{N}_{1}[\phi] = -\frac{1}{c^{2}} \left[3a_{3} \left(2\phi\phi_{z}^{2} + \phi^{2}\phi_{zz} \right) + 2a_{2} \left(\phi_{zz}\phi_{z} + \phi_{z}^{2} \right) \right]
\mathcal{N}_{2}[\phi] = -\frac{1}{c^{2}} \left[3a_{3} \left(2\phi\phi_{z}^{2} + \phi^{2}\phi_{zz} \right) + 5a_{5} \left(4\phi^{3}\phi_{z}^{2} + \phi^{4}\phi_{zz} \right) \right]$$

Reversible System

Solitary Wa

Backgroun

Normal Forms

Bilinear Functions

Literature Revi

Travelling Wave

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Travelling Wave

Result

GPC MS

A Generalized Microstructure PDE

$$v_{tt} - bv_{xx} - \frac{\mu}{2} \left(v^2 \right)_{xx} - \delta \left(\beta v_{tt} - \gamma v_{xx} \right)_{xx} = 0$$
 (6)

Overview

Definitions Reversible System

Background Normal Forms

Bilinear Functions

Literature Revie

CPC

Travelling Wave

MC

Travelling Wave

Travelling Wa

GPC MS

Travelling Wave ODE

Let z=x-ct and $u(x,t)=\phi(z)$ to reduce to the Travelling Wave ODE

$$\phi_{zzzz} - q\phi_{zz} + p\phi = \mathcal{N}[\phi] \tag{7}$$

where

$$\mathcal{N}\left[\phi\right] = -\Delta_1 \phi_z^2 - b\Delta_1 \phi \phi_{zz} \tag{8}$$

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Reversible System

Solitary Wa

Backgrou

Normal Forms

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Literature Revie

Travelling Wave

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Travelling Wave

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GPC MS

Results: The Generalized Pochammer-Chree Equations

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Reversible System

Solitary Wa

Backgroun

Normal Forms

Bilinear

Literature Revie

GPC

Travelling Wave

MS

Travelling Wave

Results

MS

Results: A Generalized Microstructure PDE