РУХАНИ ЖАҢҒЫРУ

20 АСТАНА

ЕУРАЗИЯ ҰЛТТЫҚ УНИВЕРСИТЕТІ

Студенттер мен жас ғалымдардың
«ҒЫЛЫМ ЖӘНЕ БІЛІМ - 2018»
XIII Халықаралық ғылыми конференциясы

СБОРНИК МАТЕРИАЛОВ

XIII Международная научная конференция
студентов и молодых ученых
«НАУКА И ОБРАЗОВАНИЕ - 2018»

The XIII International Scientific Conference
for Students and Young Scientists
«SCIENCE AND EDUCATION - 2018»

12th April 2018, Astana

ҚАЗАҚСТАН РЕСПУБЛИКАСЫ БІЛІМ ЖӘНЕ ҒЫЛЫМ МИНИСТРЛІГІ
Л.Н. ГУМИЛЕВ АТЫНДАҒЫ ЕУРАЗИЯ ҰЛТТЫҚ УНИВЕРСИТЕТІ

Студенттер мен жас ғалымдардың «Ғылым және білім - 2018» атты XIII Халықаралық ғылыми конференциясының БАЯНДАМАЛАР ЖИНАҒЫ

СБОРНИК МАТЕРИАЛОВ XIII Международной научной конференции студентов и молодых ученых «Наука и образование - 2018»

PROCEEDINGS of the XIII International Scientific Conference for students and young scholars «Science and education - 2018»

2018 жыл 12 сәуір

Астана

УДК 378

ББК 74.58
Ғ 96

Ғ 96

«Ғылым және білім – 2018» атты студенттер мен жас ғалымдардың XIII Халықаралық ғылыми конференциясы = XIII Международная научная конференция студентов и молодых ученых «Наука и образование - 2018» = The XIII International Scientific Conference for students and young scholars «Science and education - 2018». – Астана: http://www.enu.kz/ru/nauka/nauka-i-obrazovanie/, 2018. – 7513 стр. (қазақша, орысша, ағылшынша).

ISBN 978-9965-31-997-6

Жинаққа студенттердің, магистранттардың, докторанттардың және жас ғалымдардың жаратылыстану-техникалық және гуманитарлық ғылымдардың өзекті мәселелері бойынша баяндамалары енгізілген.

The proceedings are the papers of students, undergraduates, doctoral students and young researchers on topical issues of natural and technical sciences and humanities.

В сборник вошли доклады студентов, магистрантов, докторантов и молодых ученых по актуальным вопросам естественно-технических и гуманитарных наук.

УДК 378

ББК 74.58

ISBN 978-9965-31-997-6

году. Спутники GPS летают на орбите высотой около 20 000 км. Помимо спутников в систему GPS входит сеть наземных станций слежения за ними и неограниченное количество пользовательских приемников-вычислителей, среди которых и ставшие очень популярными в последние годы приемники автомобильных систем навигации.

По радиосигналам спутников GPS-приемники пользователей устойчиво и точно определяют координаты; для этого на поверхности Земли приемнику необходимо принять сигналы как минимум от трех спутников. Погрешности не превышают десятков метров.

Этого вполне достаточно для решения задач навигации подвижных объектов (самолеты, корабли, космические аппараты, автомобили и т. д.).

Вопрос подключения к широкополосному доступу в интернет СНП можно решит через низкоорбитальных спутников (высотой около 1000 км.), которые обеспечат качественный доступ в интернет в любой точке Казахстана без проводов.

Подключение к широкополосному доступу в интернет в сельских населенных пунктах Республики Казахстан рассматривается по нескольким критерям: создание сети, скорость Интернета, трафик, параметры, затраты по количеству населения СНП и т.д.

Вышеуказанные материалы по технологиям позволяют решит данную вопросу.

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Подсекция 1.3. Физика

UDC 532.5; 519.95

CONSTRUCTING THE LAX PAIRS FOR THE (1+1) DIMENSIONAL EVOLUTION EQUATIONS

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Introduction. The inverse scattering transform (IST) was first developed and applies to the Korteweg-de Vries (KdV) equation and its higher order analogues by Gardner, Greene, Kruskal and Miura (1967), (1974) [1]. At that time and shortly thereafter it was by no means clear if the method would apply to other physically significant nonlinear evolution equations. However, Zakharov and Shabat (1972) showed that the method was not a fluke [2] . Using a technique first introduced by Lax (1968) they showed that the nonlinear Schrodinger equation

$$iq_t = q_{xx} + kq^2q^*, \qquad k > 0 \tag{1}$$

is related to a certain linear scattering problem. Applying direct and inverse scattering ideas, they were able to solve (1) given initial values $q(x,0)$ that decayed sufficiently rapidly as $|x| \to \infty$. Shortly thereafter, Wadati (1972), using these ideas, gave a method of solution for the modified Korteweg-de Vries (mKdV) equation

$$q_t + 6q^2 q_x + q_{xxx} = 0 \quad (2)$$

and Ablowitz, Kaup, Newell and Segur (1973) did the same for the "sine-Gordon" equation

$$u_{xt} = \sin u \quad (3)$$

These results already showed the power and versatility of IST to solve certain physically interesting nonlinear PDE's

Ablowitz,Kaup, Newell and Segur developed procedures which, given a suitable scattering problem, allow one to derive the nonlinear evolution equations solvable by IST with that scattering problem. For example, it turns out that the KdV, modified KdV, nonlinear Schrodinger, and the sine-Gordon equation can all shown to be related to one master eigenvalue problem [3].

Ablowitz, Kaup, Newell and Segur method. We begin by briefly considering the essential ideas behind Lax's (1968) approach [2-3]. Consider two linear equations

$$v_x = Lv \quad (4)$$
$$v_t = Mv \quad (5)$$

where v is an n-dimensional vector and L, M are 2×2matrices.

$$L = \begin{pmatrix} -i\lambda & q \\ r & i\lambda \end{pmatrix} \quad (6)$$

And

$$M = \begin{pmatrix} A & B \\ C & -A \end{pmatrix} \quad (7)$$

Then cross differentiation (i.e., taking $\frac{\partial}{\partial t}$ (4), $\frac{\partial}{\partial x}$ (5) and setting them equal) yields

$$L_t - M_x + [L, M] = 0 \quad (8)$$

As an example we consider (1+1) dimensional generalized nonlinear Schrodinger equation. Substituting our matrices into equation (8), we obtain

$$\begin{pmatrix} 0 & q_t \\ r_t & 0 \end{pmatrix} - \begin{pmatrix} A_x & B_x \\ C_x & -A_x \end{pmatrix} + \begin{pmatrix} -i\lambda & q \\ r & i\lambda \end{pmatrix} \begin{pmatrix} A & B \\ C & -A \end{pmatrix} - \begin{pmatrix} A & B \\ C & -A \end{pmatrix} \begin{pmatrix} -i\lambda & q \\ r & i\lambda \end{pmatrix} =$$
$$\begin{pmatrix} -A_x + qC - rB & q_t - B_x - 2i\lambda B + 2qA \\ r_t - C_x + 2rA + 2i\lambda C & A_x + rB - qC \end{pmatrix} = 0 \quad (9)$$

We readily find that the equations of A,…, B satisfy

$$\begin{gathered} A_x - qC + rB = 0 \\ q_t - B_x - 2i\lambda B - 2qA = 0 \\ r_t - C_x + 2rA + 2i\lambda C = 0 \\ -A_x = qC - rB \end{gathered} \quad (10)$$

Without loss of generality we can take $-A = A$ in what follows. Thus we have

$$A_x - qC + rB = 0$$
$$q_t - B_x - 2i\lambda B - 2qA = 0 \quad (11)$$
$$r_t - C_x + 2rA + 2i\lambda C = 0$$

At this point we wish to solve the set of equation (11) for A, B, C.

Since λ, the eigenvalue, is a free parameter, we try for an exact truncated power series solution to (11) in power of λ. A simple expansion which yields an interesting nonlinear evolution equation is

$$A = \sum_{k=0}^{4} A_k(x,t)\,\lambda^k$$
$$B = \sum_{k=0}^{4} B_k(x,t)\,\lambda^k \quad (12)$$
$$C = \sum_{k=0}^{4} C_k(x,t)\,\lambda^k$$

Substituting (12) in (11) and equating to zero the coefficients of the different powers of λ in equation (11), we obtain the following system of recurrence relations

$$(A_0 + A_1\lambda + A_2\lambda^2 + A_3\lambda^3 + A_4\lambda^4)_x = q(C_0 + C_1\lambda + C_2\lambda^2 + C_3\lambda^3 + C_4\lambda^4) - r(B_0 + B_1\lambda + B_2\lambda^2 + B_3\lambda^3 + B_4\lambda^4)$$

$$q_t - (B_0 + B_1\lambda + B_2\lambda^2 + B_3\lambda^3 + B_4\lambda^4)_x - 2i\lambda(B_0 + B_1\lambda + B_2\lambda^2 + B_3\lambda^3 + B_4\lambda^4) - 2q(A_0 + A_1\lambda + A_2\lambda^2 + A_3\lambda^3 + A_4\lambda^4) = 0$$

$$r_t - (C_0 + C_1\lambda + C_2\lambda^2 + C_3\lambda^3 + C_4\lambda^4)_x + 2r(A_0 + A_1\lambda + A_2\lambda^2 + A_3\lambda^3 + A_4\lambda^4) + 2i\lambda(C_0 + C_1\lambda + C_2\lambda^2 + C_3\lambda^3 + C_4\lambda^4) = 0$$

$$A_{0x} = qC_0 - rB_0$$
$$\lambda^0: q_t - B_{0x} - 2qA_0 = 0 \quad (13\text{ a, b, c})$$
$$r_t - C_{0x} + 2rA_0 = 0$$

$$A_{1x} = qC_1 - rB_1$$
$$\lambda^1: -B_{1x} - 2iB_0 - 2qA_1 = 0 \quad (14\text{ a, b, c})$$
$$-C_{1x} + 2rA_1 + 2iC_0 = 0$$

$$A_{2x} = qC_2 - rB_2$$
$$\lambda^2: -B_{2x} - 2iB_1 - 2qA_2 = 0 \quad (15\text{ a, b, c})$$
$$-C_{2x} + 2rA_2 + 2iC_1 = 0$$

$$A_{3x} = qC_3 - rB_3$$
$$\lambda^3: -B_{3x} - 2iB_2 - 2qA_3 = 0 \quad (16\text{ a, b, c})$$
$$-C_{3x} + 2rA_3 + 2iC_2 = 0$$

$$A_{4x} = qC_4 - rB_4$$
$$\lambda^4: -B_{4x} - 2iB_3 - 2qA_4 = 0 \quad (17\text{ a, b, c})$$
$$-C_{4x} - 2rA_4 + 2iC_3 = 0$$

$$\lambda^5: \begin{matrix} -2iB_4 = 0 \\ 2iC_4 = 0 \end{matrix} \quad (18\text{ a, b, c})$$

if $k = 4$, then $C_4 = B_4 = 0$. Substituting this, we find A_4

$$A_{4x} = qC_4 - rB_4 = 0$$
$$A_4 = a_4 = const$$

Then we find C_3 by equation (17, c)

$$-C_{4x} - 2rA_4 + 2iC_3 = 0$$
$$C_3 = -\frac{2rA_4}{2i}\frac{(-i)}{(-i)} = ira_4$$

also we find B_3 by equation (17, b)

$$-B_{4x} - 2iB_3 - 2qA_4 = 0$$
$$B_3 = -\frac{2qA_4}{2i}\frac{(-i)}{(-i)} = iqa_4$$

We can obtain $A_3$from equation (16, a)

$$A_{3x} = qC_3 - rB_3 = 0$$
$$A_{3x} = iqra_4 - iqa_4 = 0$$
$$A_3 = a_3 = const$$

Then we find B_2 by equation (16, b)

$$-B_{3x} - 2iB_2 - 2qA_3 = 0$$
$$B_2 = \frac{i}{2}B_{3x} + iqA_3 = -\frac{1}{2}a_4q_x + iqa_3$$

also we obtain C_2 by equation (16, c)

$$-C_{3x} + 2rA_3 + 2iC_2 = 0$$
$$C_2 = -\frac{i}{2}C_{3x} + irA_3 = \frac{1}{2}a_4r_x + ira_3$$

Find A_2 by equation (15, a)

$$A_{2x} = qC_2 - rB_2 = \frac{1}{2}a_4(qr)_x$$
$$A_2 = \frac{1}{2}a_4qr + a_2$$

Then we find B_1 by equation (15, b)

$$-B_{2x} - 2iB_1 - 2qA_2 = 0$$
$$B_1 = \frac{i}{2}B_{2x} + iqA_2 = -\frac{i}{4}a_4q_{xx} - \frac{1}{2}a_3q_x + \frac{i}{2}a_4q^2r + ia_2q$$

also we find C_1 by equation (15, c)

$$-C_{2x} + 2rA_2 + 2iC_1 = 0$$
$$C_1 = -\frac{i}{2}C_{2x} + irA_2 = -\frac{i}{4}a_4r_{xx} + \frac{1}{2}a_3r_x + \frac{i}{2}a_4r^2q + ia_2r$$

We can obtain$A_1$from equation (14, a)

$$A_{1x} = qC_1 - rB_1 = -\frac{i}{4}a_4(qr_{xx} - rq_{xx}) + \frac{1}{2}a_3(qr_x + rq_x)$$
$$A_1 = -\frac{i}{4}a_4(qr_x - rq_x) + \frac{1}{2}a_3qr + a_1$$

We find B_0 by equation (14, b)

$$-B_{1x} - 2iB_0 - 2qA_1 = 0$$

$$B_0 = \frac{i}{2}B_{1x} + iqA_1 = \frac{1}{8}a_4q_{xxx} - a_4rqq_x - \frac{i}{4}a_3(q_{xx} - 2q^2r) - \frac{1}{2}a_2q_x + ia_1q$$

And C_0 we obtain from equation (14, c)

$$-C_{1x} + 2rA_1 + 2iC_0 = 0$$

$$C_0 = -\frac{i}{2}C_{1x} + irA_1 = -\frac{1}{8}a_4r_{xxx} + a_4qrr_x - \frac{i}{4}a_3(r_{xx} - 2r^2q) + \frac{1}{2}a_2r_x + ia_1r$$

Then we obtain A_0 by equation (13, a)

$$A_{0x} = qC_0 - rB_0 = -\frac{1}{8}a_4(qr_{xxx} + rq_{xxx}) + a_4(q^2rr_x + r^2qq_x) - \frac{i}{4}a_3(qr_{xx} - rq_{xx}) + \frac{1}{2}a_2(qr_x + rq_x)$$

$$A_0 = -\frac{1}{8}a_4(q_{xx}r + qr_{xx} - q_xr_x) + a_4q^2r^2 - \frac{i}{4}a_3(qr_x - rq_x) + \frac{1}{2}a_2qr + a_0$$

Substituting the values of A_0 into equations (13 b, c), we obtain a (1+1) -dimensional generalized nonlinear Schrödinger equation in the form

$$q_t - \frac{1}{8}a_4q_{xxxx} + a_4(rqq_x)_x + \frac{i}{4}a_3(q_{xxx} - 4rqq_x - 2q^2r_x) + \frac{1}{2}a_2q_{xx} - ia_1q_x + \frac{1}{4}a_4(rqq_{xx} + q^2r_{xx} - qq_xr_x) - 2a_4q^3r^2 + \frac{i}{2}a_3(q^2r_x - rqq_x) - a_2q^2r + 2a_0q = 0$$

$$r_t + \frac{1}{8}a_4r_{xxxx} - a_4(qrr_x)_x + \frac{i}{4}a_3(r_{xxx} - 4qrr_x - 2r^2q_x) - \frac{1}{2}a_2r_{xx} - ia_1r_x - \frac{1}{4}a_4(r^2q_{xx} + qrr_{xx} - rr_xq_x) + 2a_4q^2r^3 - \frac{i}{2}a_3(qrr_x - r^2q_x) + a_2r^2q + 2a_0r = 0$$

Evolution equations of physical interest are obtained as special cases:

Case 1: $a_0 = 0, a_1 = 0, a_2 = -2i, a_3 = 0, a_4 = 0, r = -q^*$

$$q_t - i(q_{xx} + 2q^2q^*) = 0$$

$$r_t + i((-q^*)_{xx} + 2q^*(-q^*)^2 = 0$$

We have (1+1) dimensional nonlinear Schrodinger equation.

Case 2: $a_0 = 0, a_1 = 0, a_2 = -2i, a_3 = 0, a_4 = -2i, r = -\bar{q}$

$$q_t + \frac{i}{4}(q_{xxxx} + 8(q\bar{q}q_x)_x + 2q\bar{q}q_{xx} - 2q^2(-\bar{q})_{xx} + 2qq_x(-\bar{q})_x + 16q^3(-\bar{q})^2 - i(q_{xx} + 2q^2\bar{q}) = 0$$

$$r_t - \frac{i}{4}((-\bar{q})_{xxxx} + 8\big(q\bar{q}(-\bar{q}_x)\big)_x - 2q_{xx}(-\bar{q})^2 + q\bar{q}(-\bar{q})_{xx} + 2q_x\bar{q}(-\bar{q})_x + 16q^2(-\bar{q})^3 + i((-\bar{q})_{xx} - 2q(-\bar{q})^2) = 0$$

We obtained (1+1) dimensional generalized nonlinear Schrodinger equation.

Conclusion. In this paper we consider (1+1) dimensional generalized nonlinear Schrodinger equation. We described about inverse scattering transform with respect to the Kortega-de Vries equation. Applied Ablowitz, Kaup, Newell, and Segurmethod for (1+1) dimensional generalized nonlinear Schrodinger equation.

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UDC 517.957, 532.5

EXTENDED HYPERBOLIC TANGENT METHOD FOR GARDNER EQUATION

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Introduction. In this paper, we consider the Gardner equation in the following view [1]

$$\begin{cases} u_t = (\beta \cdot \omega - \frac{\beta^2}{2} \cdot u^2 + \delta \cdot u) \cdot u_x + \omega_y + \varepsilon^2 u_{xxx} \\ u_y - \omega_x = 0 \end{cases}, \qquad (1)$$

where $u(t,x,y)$ represents the fluid velocity in the horizontal direction x and in the vertical direction y, $\beta, \delta, \varepsilon$ are positive constants.

The aim of the paper is to obtain new kind of solutions for the Gardner equation based on extended tanh method [2-4], and with the help of Maple.

Extended hyperbolic tangent method for Gardner equation. Consider the Gardner equation (1). We convert equation (1) to an ordinary differential equation

$$-cu' - \beta uu' + \frac{\beta^2}{2}u^2u' - \delta uu' - u' - \varepsilon^2 u''' = 0, \qquad (2a)$$
$$u' - \omega' = 0. \qquad (2b)$$

After we integrate equation (2) until all terms have derivatives

$$\beta^2 u^3 - u^2(3\beta + 3\delta) - 6u - 6cu - 6\varepsilon^2 u'' = 0 \qquad (3a)$$
$$u = \omega. \qquad (3b)$$

Balancing $u^3$and u'' in the equation (3a) gives $3M = M + 2$. So that $M = 1$.The extended tanh method admits the use if the finite expansion

$$u(x,t) = a_0 + a_1 Y + a_2 Y^2 + b_1 Y^{-1} + b_2 Y^{-2}. \qquad (4)$$

Substituting (4) into (3), and collecting the coefficients of Y ,we obtain a system of algebraic equations for $a_0, a_1, a_2, b_1, b_2, \mu$

$$Y^3 : a_1^3\beta^2 - 12a_1\mu^2\varepsilon^2 = 0, \qquad (5a)$$

$$Y^2 : 3a_0a_1^2\beta^2 - 3a_1^2\beta - 3a_1^2\delta = 0, \qquad (5b)$$

$$Y : 3a_0^2a_1\beta^2 + 3a_1^2b_1\beta^2 + 12a_1\mu^2\varepsilon^2 - 6a_0a_1\beta - 6a_0a_1\delta - 6a_1c - 6a_1 = 0, \qquad (5c)$$