SUMMARY

The summary of the present work is as follows :

A : Exact solutions

A-1 : Exact solutions of Yang equation (2-4):

Under some assumptions and transformations of variables the Yang equations (2-4), under study lead to conformally invariant equations permitting one to obtain infinitely many other solutions from any solution of these conformally invariant equations. It is of further interest to observe that these conformally invariant equations closely resemble the mathematically interesting generalized Lund-Regge equations. Some exact solutions of these conformally invariant equations have been obtained. Except for some singular situations these solutions satisfy the condition for self-duality.

The details are in our paper [P-1] and in the article (6-1-1).

A-2 : Exact solutions of Charap equations

Under similar assumptions and transformation of variables as in A-1, the Charap equations (2-8) under study generate two new types of solutions. Each type allows infinite number of solutions. It has also been shown that Chiral invariant field equations admit invariance for a transformation of the dependent variables.

The details are in our published paper [P-2] and in the article (6-1-2).

A-3: Proposal and Exact solutions of Combined equation (2-10):

Here the Combined equations were proposed.

Using same type of ansatz as used in A-1 & A-2 exact solutions of Yang and Charap equations were rediscovered. Finally, using exactly the same ansatz exact solutions of Combined equations were obtained.

The details are in our paper [P-3] and in the article (6-1-3).

B :Graphical representation

ϕ, ψ and χ as obtained in exact solutions discussed earlier for the three equations under study are shown graphically. Observation shows that

(i) Spreading wave with solitary profile which tends to vanish as time tends to infinity (in case of Yang equations [28] and combined (extended Yang) equations [31]).

(ii) Solitary wave with oscillatory profile(in case of Charap equations [29]).

(iii) Localized wave with solitary profile which becomes plane wave periodically & abruptly and wave packet/s which are oscillatory in nature and become zero periodically & abruptly (in case of Combined (extended Charap) equation [31])

(iv) All the solutions are basically localized in character.

The details are in our published paper [P-4] and in the article (6-2) .

C : Painleve' test & discussion of chaos

C-1 : Painleve' test for Yang equations (2-4)

Painleve' test (as given by Jimbo, Kruskal, Miwa [49]) for integrability for the Yang's equations under study has been revisited. Jimbo, Kruskal and Miwa analysed the complex form of the equations with a rather restricted form of singularity manifold. They did not discuss about exact solutions in that context. Here the analysis has been done starting from the real form of the same equations and keeping the singularity manifold completely general in nature. It has been found that the equations, in real form, pass the Painleve' test for integrability. The truncation procedure of the same analysis leads to non-trivial exact solutions obtained previously and Auto-Backlund transformation between two pairs of those solutions.

The details are in our published paper [P-5] and in the article (6-3-1) .

C-2 : *<u>Painleve' test of Charap equation (2-8)</u>*:

It has been shown that the equations under study pass the Painleve' test for complete integrability in the sense of Weiss et al. The truncation procedure of the same analysis leads to Auto-Backlund transformation between two pairs of solutions. With the help of this transformation non-trivial exact solutions have been rediscovered.

The details are in our published paper [P-6] and in the article (6-3-2).

C-3 : *<u>Painleve' test of Combined equation (2-10)</u>* :

(equation 2-10 a,b,c with $\varepsilon = \pm 1$, $k' = 1$, $k' = 1$)

The equations (2-10) , under study allow none of the stages i.e. leading order analysis, resonance calculation and checking of the existence of requisite number of arbitrary functions) to be conclusive.

The details are in our (communicated) paper [P-7] and in the article (6-3-3).

C-4: Discussion of Chaos in the perspective of Painleve' analysis & graphical study :

We have made a comparative study of the Painleve' test & graphical representation of some exact solutions. The observations have been placed in a tabular form in article (6-3-4). Thereform we arrive at a conjecture related to the existence of regular behaviour (e.g. existence of solitonic behaviour).

The conjecture is as follows:

The basic requirement for the existence of the regular behaviour as stated above is the existence of requisite number of arbitrary functions at the resonance points in the Laurent-like expansion used for the Painleve' test. In addition to that the Laurent-like expansion must be well behaved at all the stages – namely, leading order analysis, resonance calculation and checking of the existence of the requisite number of arbitrary functions.

The details are in article (6-3-4).