On alphabetical shaped soliton for intrinsic fractional coupled nonlinear electrical transmission lattice using sine-cosine method,

FENDZI-DONFACK EMMANUEL[1,2,*], TCHEPEMEN NKOUESSI NATHAN[1], TALA-TEBUE ERIC[3], KENFACK-JIOTSA AURELIEN[2].

1. *Pure Physics Laboratory, Group of Nonlinear Physics and Complex Systems,Department of Physics,Faculty of Sciences, University of Douala, P.O. Box 24157, Douala, Cameroon*.
2. *Nonlinear Physics and Complex Systems Group, Department of Physics,The Higher Teacher's Training College, University of Yaounde I, P.O. Box 47 Yaoundé, Cameroon*.
3. *Laboratoire d'Automatique et d'Informatique Appliqué (LAIA), IUT-FV of Bandjoun, The University of Dschang, BP 134, Bandjoun, Cameroon*.

* Presenting Author [ORCID: 0000-0001-8635-1159].

Abstract: We investigate the effect of fractional order on alphabetical shaped solitons solutions for intrinsic fractional (2+1)-D coupled nonlinear electrical transmission lattice using sine-cosine method in addition to higher order of dispersion.

Keywords: Fractional complex transform, sine-cosine method and fractional alphabetical shaped solitons.

1. Introduction (10 point, bold)

In recent years, investigating on solitary waves called solitons has been of great interest **[1]**. More recently, researchers pay attention on fractional calculus and prove that it is a useful tool to model faithfully nonlinear complex physical phenomena (NCPP) **[2-4]**. In fact, introducing fractional derivative operators in NPDEs modelling nonlinear complex systems (NCS) such as nonlinear electrical transmission lines or lattice (NETLs) is fascinating for some aims like involve the memory effect. So, obtain exact solutions of fractional nonlinear partial differential equations (FNPDEs) is utmost important as well as derive ones of the NPDEs **[2-5]**. In this study, we consider the Curie's empirical law [6] governing the current flowing through a fractional nonlinear capacitor such as through the skin effect, this empirical law is also applied to the inductor. This fractional derivatives Ohm's laws lead us for a (2+1)-D NETL **[7]** to get an intrinsic fractional discrete NPDE (FDNPDE) of the voltage wave. We derive by using the semi-discrete approximation with higher order of dispersion in addition to fractional complex transform a nonlinear evolution equation (NEE) solved by the sine-cosine method **[8]**.

2. Results and Discussion (10 point, bold)

By using the Kirchhoff's laws in addition of Curie's empirical laws, we get:

$$\frac{d^{2\delta}C_0\left(V_{n,m}-aV_{n,m}^2+bV_{n,m}^3\right)}{dt^{2\delta}}=\frac{1}{L_1}\left(V_{n+1,m}-V_{n-1,m}+2V_{n,m}\right)+\frac{1}{L_2}\left(V_{n,m+1}-V_{n,m-1}+2V_{n,m}\right),0<\delta\leq 1. \quad (1)$$

By introducing the semi-discrete approximation with higher order of dispersion in addition to the fractional complex transform (FCT)

$$V_{n,m}(t) = V(t,x,y) = A\cos^{p}(\xi), \quad \xi = k_1 x + k_2 y + \frac{ct^{\delta}}{\Gamma(1+\delta)}, k_1 = k_2 = k \tag{2}$$

with A, p, k and c the unknown parameter. We obtain a NEE such as the solutions are established through the sine-cosine method. Some findings depicted below show singular bright solitary wave (SBSW) such as, due to the fractional order (FO), we attain M-shaped solitons and explore more amplified solutions like bright solitary wave (BSW) depending on physical parameters and FO.

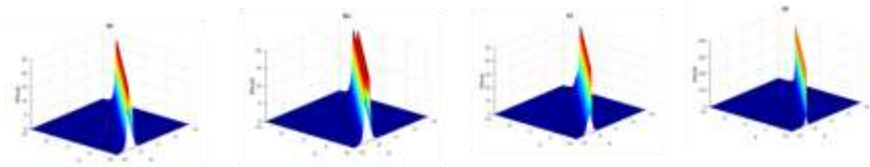

Fig. 1. These graphs display $|V(x,y)|$ with $U_0 = 3, l_1 = 1, W_0 = 4, l_2 = 1, a = 0.21, b = -0.0197, t = 1: (a)\ \delta = 1, (b)\ \delta = 0.975, (c)\ \delta = 0.875, (d)\ \delta = 0.75.$

3. Concluding Remarks (10 point, bold)

We have investigated the effect of fractional order on alphabetical shaped solitons solutions for an intrinsic fractional (2+1)-D coupled nonlinear electrical transmission lattice by using sine-cosine method in addition to fractional complex transform.

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