The Torsional Spaces and Fields: The Torsional Fields and Waves with the Torsional Coordinates Systems Family

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Abstract

The torsional coordinates systems family is developed. The multi-axial torsion structures are studied. The circularly cylindrical torsional coordinates system is given as first application. The weighted torsional coordinates are defined to provide separable solutions of the wave equation. The extended and the expanded separation methods are modified in the inflective coordinates for the solutions of wave equation related to the torsional and multi-axis torsional flow structures. Both of the charge distributions and current distributions are studied on the Möbious Strip-like paths. The solutions are studied for both of the field equation and the wave equation involving the torsional structures.

1. Introduction

The central topic is related to the *initial boundary value problems*, *IBVP*s and the *mixed boundary value problems, MBVPs* of the processes among the most primitive mechanisms and particle-like, pseudo-particle, and/or virtual-particle structures interacting with waves in events involved with this contribution. The *Torsional Coordinates Systems*, *TCS*s family is developed related to the solution of the *IBVPs and MBVPs*. The circularly cylindrical *TCS* is given as first application for the topic. The extended and expanded separation methods are modified for the solutions of wave equation related to the torsional and multi-axis torsional flow structures from [1, 2, 3, 4]. The Möbious Strip-like source distributions are studied with the torsional circularly cylindrical coordinates.

2. The Basics of Torsional Coordinates Family

The torsion $\tau(\ell)$ applies around tangential line on a linearly straight line while the point P moves in the positive direction of ℓ on the straight-line L, continuously. If the orthogonally rectangular coordinates are in use, then this torsion scheme translates to axial torsions on the coordinate direction lines: (a) The torsion around x, (b) The torsion around y, and (c) The torsion around z (see Fig. 1).

The torsional events are in three categories: 1. The spontaneous torsions, 2. The torqued torsions, and 3. The mixed torsions. The 2nd category has three subcategories: a) The torsions, those are generated with the internal torques, b) The torsions, those are created with the external torques, and c) The torsions, those are created with the unifications of previous 2 subcategories. The 3rd category is the combinations of all categories. The events of 1st category are discussed in the evaluations of the topics of this contribution.

2.1 The Torsionally Linear Line

Let us take a straight-line L as the path for source. We may consider a continuous torsion $\tau_x(x)$ around the axis x for a BVP as a possible configuration related to the path L in Figure 1. The axis x rotates with an angle $\tau_x(x)$, continuously, while the point P moves on the axis x in the positive direction for x.

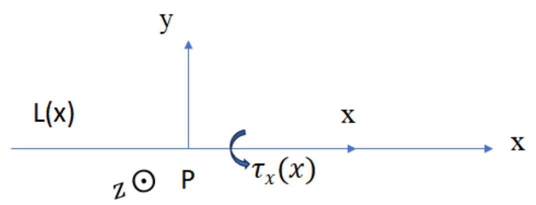

Figure 1. The torsional straight-line L(x): The torsion $\tau_x(x)$ applies around the axis-x while the point P moves in positive direction of x on the straight line on the axis-x.

2.2 The Torsionally Curved Arbitrary Paths

The torsion $\tau(s)$ applies around tangential line on an arbitrary curve L(s), continuously. If the orthonormal triplet $(\vec{t},\vec{n},\vec{b})$ is in use, then this torsion scheme translates to multi-axis torsions on the moving trihedron: (a) The torsion around $\vec{t}$, (b) The torsion around $\vec{n}$, and (c) The torsion around $\vec{b}$. The triplet $(\vec{t},\vec{b},\vec{n}^*)$ is more versatile with respect to the triplet $(\vec{t},\vec{n},\vec{b})$ as a consequence that the torsion is the intrinsic property of the curve, where $\vec{n}^*= -\vec{n}$, The triplet $(\vec{t},\vec{b},\vec{n}^*)$ provides to obtain the separable solutions of second order partial differential equations related to the *initial boundary value problems*, *IBVP and* the *mixed boundary value problems*, *MBVP* for both of the field and wave equations.

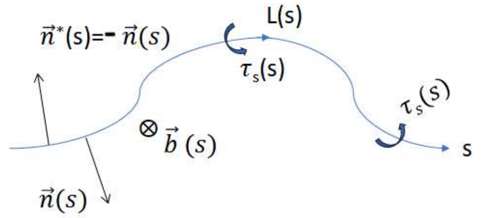

Figure 2. The torsional curve L(s): The torsion $\tau_s(s)$ applies around tangential line while the point P moves in positive direction of arc length s on the curve L.

Both of the triplet $(\vec{t}, \vec{n}, \vec{b})$ and the triplet $(\vec{t}, \vec{b}, \vec{n}^*)$ are right-handed orthonormal moving trihedrons. Figure 2 depicts both of two moving trihedrons on an arbitrarily curved path L(s) with a continuously spontaneous torsion $\tau_s(s)$.

2.3 The Circularly Cylindrical Continuously Torsional Coordinates

The axis $\vec{t}$ rotates as $\tau(\phi)$ around itself while a point P moves in positive rotation direction on C with respect to ϕ, continuously. This torsion is equivalent to simultaneous rotations around the axis-y and axis-x for $\vec{t}(P)$ as $\varphi_{ty} = s_{ty}\phi$ and $\varphi_{tx} = s_{tx}\phi$, respectively. This torsion gives the torsioned $\vec{t}$ as $\vec{t}_\phi(P)$ in equation 1 below:

$$\begin{aligned}\vec{t}_\phi(P) &= \vec{e}_x cos\varphi_{ty} + \\ &+\vec{e}_y\big(sin\phi cos\varphi_{tx} - sin\varphi_{tx} sin\varphi_{ty}\big) + \\ &+\vec{e}_z(sin\phi sin\varphi_{tx} cos\varphi_{tx} sin\varphi_{ty})\end{aligned} \quad (1).$$

The equivalences are obtained for the rotations of the axis $\vec{b}$ and the axis $\vec{n}^*$, similarly. The axis $\vec{b}$ rotates as $\tau(\phi)$ around $\vec{t}$ while a point P moves in positive rotation direction on C with respect to ϕ, continuously. This torsion is equivalent to simultaneous rotations around the axis-y, axis-x, and axis-z for $\vec{b}(P)$ as $\varphi_{by} = s_{by}\phi$ and $\varphi_{bx} = s_{bx}\phi$, and $\varphi_{bz} = s_{bz}\phi$, respectively. This torsion gives the torsioned $\vec{b}$ as $\vec{b}_\phi(P)$. Here, the parameters s_{ty},…, and s_{bz} are the weight parameters [5, 6]. The orthonormal triplets $\vec{t}_\phi(P)$, $\vec{b}_\phi(P)$, and $\vec{n}^*(P)$ are the circularly cylindrical continuously torsional weighted coordinates. Figure 3 illustrates the definitions of the circularly cylindrical continuously torsional coordinates. The weight parameters are constants in this contribution. They are specific polynomials of ϕ in general cases.

2.4 The Möbius Strip-Like Paths

If we take a strip L_S instead of line L and apply a continuous torsion to it as curve C by using the torsional direction, that we used when defining the basics of torsional coordinates, then we get a Möbius Strip that has continuously torsional structure: This structure is the *circularly cylindrical continuously torsional Möbius Strip*, *CCCTMS*.

3. The Torsional Source Distributions

First, the *torsionally linear lines*, *TLLs* are considered carrying charge distributions and/or current filaments. These first kind of sources are the *right-handed torsionally linear lines* carrying *charge distributions* and/or *current distributions*, that the source paths have definitions in the section 2.1. Second, the *circularly cylindrical continuously torsional charge distributions* and/or *current filaments*, *CCCTCD*s and/or *CCCTCFs* are studied. Some examples are of those sources: 1) The *torsionally closed structures*, *TCS*s: The *torsional ring source*, *TRS* 2) The *torsionally segmented structures*, *TSSs*: The *circularly torsional current filament*, *CTCF*, and 3) The *circularly cylindrical continuously torsional Möbius Strip sources*, *CCCTMSSs*.

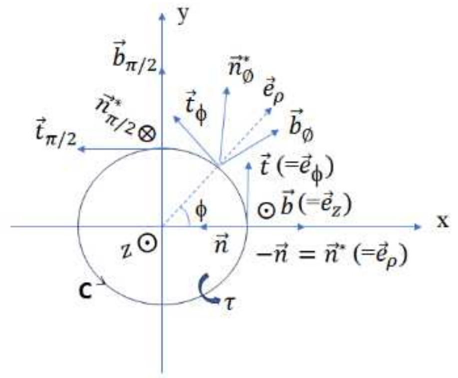

Figure 3. The circularly cylindrical continuously torsional coordinates: The torsion $\tau(\phi)$ applies around tangential line while the point P moves in positive direction for rotation on the circularly cylindrical curve C.

Those second kind of sources are the *right-handed circularly cylindrical continuously torsional curves* carrying *charge distributions* and/or *current distributions,* that the source paths have definitions in the section 2.3 in the above-mentioned examples related to the *CCCTCD*s and/or the *CCCTCFs*.

4. The Torsional Fields and Waves

The solutions are constructed with the weighted torsional coordinates family by using the modified extended and expanded separation methods. The solutions involve newly derived eigenfunctions and series in the circularly cylindrical continuously torsional weighted coordinates. The details are similar to the methods in [1-6] of the analytical and topological evaluations but involve extensions and modifications, basically.

4.1 The Torsions of Temporal Axes

The torsion schemes are discussed for rotational trajectories around temporal axes for both of the time energy t^E and the time span t^s [7]. The summaries are below, those are the specific properties related to the physical effects of the basic torsional mechanisms.

Principle 1. The temporal torsions fit to the spontaneous torsions as creators of their sources.

Result 1. If the time energy (as the source and/or creator of temporal energy) dissipation goes lesser (and/or bigger) than the total temporal energy dissipation in a time span then the temporal variations go slow (and/or rapid) during that time span.

Result 2. The suitable modulations fit to the possible dark (and/or white) energy configuration topologies of the time energy with a time span in a topologically temporal domain. If the time energy variations form a mesh able metric with a suitable norm in a topologically temporal domain, then the time energy variations embed a temporal energy in that domain so that the temporal energy corresponds to the modulated harmonics of the dark (and/or white) energy ingredients.

.5. Conclusions

The torsional coordinates systems family is developed involving the multi-axial torsion structures. The circularly cylindrical torsional coordinates system is given. The weighted torsional coordinates are defined providing the separable solutions of the wave equation. The solutions are given with the modified extended and the modified expanded separation methods for the wave equation related to the torsional and multi-axis torsional source distributions. The source distributions are studied on the Möbious Strip-like torsional paths. The solutions involve the torsional structures for the wave related boundary value problems. The torsion schemes are discussed for rotational trajectories around temporal axes for both the time energy and the time span.

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