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Physics Evidence for God's Current Existence and Activity Using Einstein's General Theory of Relativity

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Abstract

Physics with its mathematical equations using Hooke's Law, Einstein's General Theory of Relativity, and Cauchy's Law of Mechanics show evidence of God's existence for the first time as a boundary value problem. Philosophical arguments for God's existence have been based upon cosmological and ontological reasons such as those from Socrates to Thomas Aquinas. However, the evidence herein does not invoke any aforementioned philosophical or logical arguments. Instead, a purely physics argument and the associated set of mathematical equations using the General Theory of Relativity and its use for the universe are shown as evidence that the Cauchy traction vector, *t*, operates on the outside of the universe, when the continuum body is assumed to be the universe. Bible verses are presented that correlate the traction force, *t*, with the hand(s) of God. Finally, since the mathematical equations provide a boundary value problem and not an initial value problem, the activity of the Cauchy traction force, *t*, is acting *now* and not just in the past, thus refuting atheism and deism.

Key Words: Cauchy Law, General Theory of Relativity, Hooke's Law

Introduction

Martin (1992) summarized the philosophical underpinnings of atheism and noted 210 million atheists and 805 million agnostics (those who claim not to know if God exists or does not exist), reaching about 21% of the world's population in 1982. Later, Dawkins (2006), Hitchens (2007), Hawking (2009), and Hitchens et al. (2019) popularized atheism around the world. In 2022, approximately 450 to 500 million atheists and agnostics self-identified worldwide (7% of the world's population) according to Keysar (2017, pp. 40–53), with China alone accounting for 200 million people of that demographic. The reason that China is predominately atheist is due to communism, which as a totalitarian political structure, declares that the "state" can take care of society, not God. Hence, no God is needed. However, it was Darwin's book (Darwin and Kepler, 1859) that was the watershed for widespread support for atheism since he hypothesized that evolution controls the origin of species, meaning that the minor species variations

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that we observe in nature give rise over time to all different species. This leads to a purely naturalistic premise that all life does not need a Creator God nor a current controlling—or influencing—God in the universe.

Counter to atheism, the Greeks were the first to argue for God's existence based on intellectual logic. Socrates (470–399 BC), Plato (427–347 BC), and Aristotle (384–322 BC) believed in God as the Prime Mover, as the First Cause, as the Unmoved Mover. Augustine (AD 354–430) (Hill, 1961) argued that historically documented testimonies provide a valid basis for knowledge of God. Anselm (AD 1033–1109) (Forshall, 1840) built upon Augustine's arguments that the first and greatest "being" must necessarily exist. Thomas Aquinas (AD 1225–1274) made five arguments about God's existence that built upon those of Socrates, Plato, Aristotle, and Anselm, which provided modern arguments (Spitzer, 2010) which Tipler (1994, pp. 1–17) presented as the Omega Point Theory:

(1) *Argument from Motion*: Since nothing can move itself because of inertia, an external agent or force is/was necessary to cause or instigate the motion that is in the universe.
(2) *Argument from Cause*: Based on the Law of Causality in which cause-effect relationships exist everywhere in the cosmos, there has to be first cause and that everything that begins to exist is an effect; thus there must be an ultimate First Cause.
(3) *Argument from Perfection* (ontological argument): The universe contains an ordered sequence of beings from the simplest basic organisms to the most advanced, complex organisms such as humans. This "ever-increasing degree of perfection" points toward a final being that must be perfect and ideal.
(4) *Argument from Design*: the Earth and its inhabitants contain an observable and a very complex order such that it could not have come about by random chance events over a long period of time but required a designer outside of the design.
(5) *Argument from Necessity* (cosmological argument): Everything that exists does so in relation to something else, so there must be a "necessary being" that is contingent on nothing else for its existence.

Hence, Aquinas said that God is perfect, self-existent, and designed everything that caused the motions in the universe. Hick (1964) summarized all of these philosophical arguments for God's existence, then presented the counterarguments from the skeptic's perspective (Russell 1992; Rand 1963, 1997; Dawkins and Ward, 2006; Hitchens, 2007), etc.) and then showed the weakness of their counterarguments.

In our current 21st century, we have had some rationalists discuss God's existence from logic's perspective. Kalanov (2007, 2009, 2010) argued a theoretical proof of existence of God by way of existence, uniqueness, and absoluteness strongly expressing the current need to conduct science in the context of absolute scientific truths using rational dialectics and commonly accepted axioms. Zacharias (2020) argued that human failures and/or evil is universally recognized, if not experienced, by everyone to their own admission. *As such, if there is evil, then logically there must be good that can only come from a good God.* Most recently, Fatić (2021, pp. 428–438) argued for an ontological proof of God's existence by use of ethics.

Mathematically, Kurt Gödel (AD 1906–1978) provided a proof that was dated around 1941 but not published until 1987. Gödel (1995a; 1995b, pp. 403–404; see also Sobel, 1987) presented an induction argument starting with observations and concluding with God's existence.

Given the context of the historical arguments for God's existence, the contribution of this paper is a new physics argument with its associated mathematics to prove God's existence. *It is not based upon philosophical arguments.* Albeit God, who exists outside of the space-time-matter universe, acted upon and still acts upon the outside boundary of the universe with His hands as a traction force to affect the internal stress state within the universe, as the universe acts as a continuum body.

Hooke's Law, Cauchy's Law, the Definition of Stress, and a Boundary Value Problem

We first discuss the basics of a boundary-value problem (BVP), Hooke's Law (Hooke, 1678), and Cauchy's Law (Cauchy, 1827). A BVP (Axelsson and Barker, 2001) essentially integrates the boundary conditions within a set of differential equations that provides the "existence" of a solution that is "unique." In continuum mechanics, we start with the conservation equations of mass, momentum, and energy and find out that we have too many equations for the number of constants, so the equations cannot be solved simultaneously. However, we can add in constitutive equations, which dictate the material identity and its behavior, we get the same number equations and unknowns, so the set of differential equations can simultaneously be solved. Hence, we can add in Cauchy's Law to bring in boundary conditions into the set of differential equations and we get a BVP.

Now to determine the constitutive relationships, we can start with Hooke's Law (Hooke, 1678), which in its original form stated that the externally applied force, F, needed to compress or extend a spring-like material by some distance, x, is linearly proportional to that distance with regard to the constant, k. Thus,

$$F = kx. \tag{1}$$

Hooke's Law was later and more conventionally associated with the stress, σ, not force, F, and strain, ε, not displacement, x, as both sides of the equation was divided by length squared

giving rise to the following equation called Generalized Hooke's Law,

$$\sigma = Y\,\varepsilon, \tag{2}$$

where Y is Young's (elastic) Modulus, ε is the strain, and σ is the stress.

In continuum mechanics, the stress, σ, measures the local force divided by the area within a deformable body on which the external forces, originally called tractions (Cauchy, 1827) act. Because the deformable body under external traction forces is assumed to be continuous, the internal stresses are distributed continuously within the volume of the material body, i.e., the stress distribution in the body is expressed as a piecewise continuous function of space coordinates and time. Actually, the definition of stress originates from Cauchy (1827) in which the stress, σ was defined from the traction force $\underline{t}$ operating on a body. Essentially, Cauchy (1827) stated that a stress tensor σ exists that maps the unit normal to a surface to the traction vector acting on that surface as the following equation,

$$t_j = \sigma_{ij} n_{i,} \tag{3}$$

where n_i is the unit direction vector, t_j is the traction vector, and σ_{ij} is the stress tensor in indicial notation.

The continuum stress is mathematically called a second rank tensor. The term tensor is a structure of numbers or functions that transforms according to a specific mathematical rule, when the independent components undergo a linear transformation. One can think of tensors as a mathematical mapping that transforms one tensor into another. The most general three-dimensional stress tensor includes nine components that are represented with a double subscript provided the range of each subscript is three. In four-dimensional space, like for the General Theory of Relativity, each subscript has four dimensions, not three. For instance, the stress tensor is designated by indicial notation as σ_{ij} and thus has nine components in three-dimensional space as *i* and *j* go from 1 to 3. Hence, the stress tensor, σ_{ij}, is internal within the body and arises from the traction forces, moments, or anything acting on the outside of the continuum body. The first subscript of the stress tensor, σ_{ij}, designates a normal to the plane under consideration, and the second subscript designates the direction of the local force. For example, let us consider the shear stress component, σ_{12}, which exists on the 1-plane but is oriented in

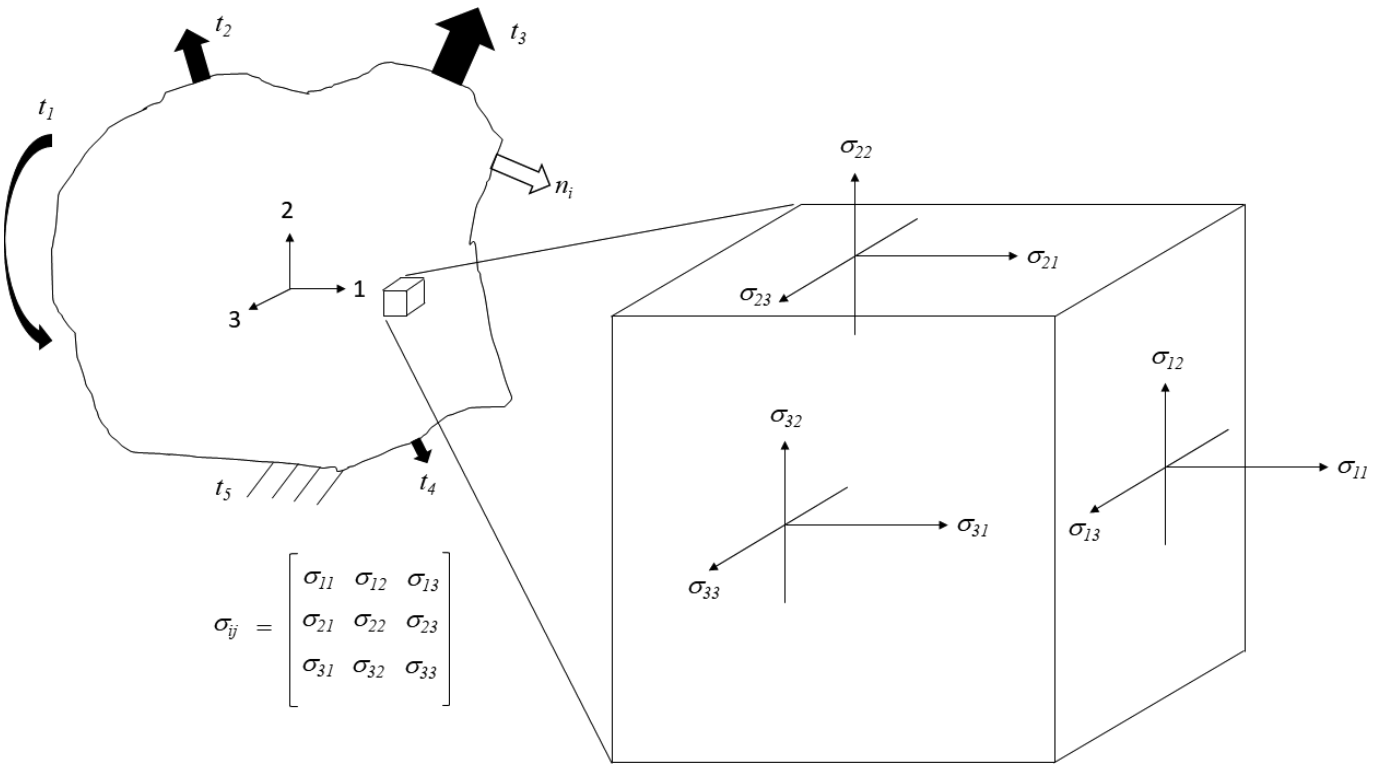


Figure 1. A generic continuum body showing the local stress tensor, σ_{ij}, and each of its components arising from the traction forces, t_1-t_5, with its associated unit vector, n_i.

the 2-direction. The positive directions of the components of shear stresses on any side of the cubic element are taken as the positive directions with respect to the coordinate axes. Figure 1 delineates each local stress component at a continuum point.

The discussion about stress (and strain) within a continuum body finds its practical relevance in solving boundary-value problems (BVPs) using finite element analysis (c.f., Axelsson and Barker, 2001). BVPs bring together the conservation of mass, momentum, and energy along with the constitutive relations (e.g., Hooke's Law) to resolve the stress (and strain) state of a continuum body, and the finite element method is a way to resolve all of the equations.

Finite Element Analysis (FEA) was first characterized by Turner et al. (1956) and Clough (1960), who first coined the term. When computers first were developed, Clough (1960, pp. 345–378) employed them to break each continuum body into smaller elements (discretization) and then tie together the elements solutions to resolve the stresses throughout the body. Since that time, finite element methods have grown to routinely be used for design, modeling, simulations, visualizations, and analysis and have been experimentally validated for very complex systems; NASA's space shuttles (Ko et al., 1986), trains crashing (Milho et al., 2003), car crashworthiness (Fang et al., 2005), planes crashing into the World Trade Center (Lynn and Isobe, 2007). Since the finite element method was invented, there probably has been over multiple millions of simulations that have been validated experimentally to illustrate its robustness, accuracy, and usefulness. Thousands of numerical methods, codes/software, and geometric meshes have been developed over time. One key in the finite element simulations is the constitutive equation or material model. The simplest constitutive equation is Equation (15), Hooke's Law. More complicated constitutive equations can be employed beyond elasticity (Hooke's Law), like viscoelasticity, plasticity, damage, etc. Hence, complicated BVPs have not only been solved by finite element methods, but they have been experimentally validated. FEA is worth ~$5 billion (research nestor, 2022) today with an estimated $12 billion impact by 2031. Even with this huge worldwide usage, nobody to date has solved the BVP of the whole universe.

One final comment related to a BVP that is important in the context of solid mechanics and the General Theory of Relativity is related to the continuum spins. The displacement, x, in Equation (1) and strain, ε, in Equation (2) relate to the geometry side of the constitutive relationship. Both of these can be derived from the deformation gradient, which is the most fundamental geometric quantity in solid mechanics. Once the deformation gradient is defined, then we can also derive the velocity gradient, which has both mathematically symmetric and antisymmetric parts. The antisymmetric part of the velocity gradient is the elastic continuum spin. Any material that has some sort of orientation, whether its crystallographic for metals, or fiber alignment for composites, presents a local anisotropy that will rotate upon deformation or a stress applied from the outside of the continuum body.

Crystal plasticity (Asaro, 1983) or texture (Kallend et al., 1991; Kocks et al., 2000) is a term for metals that has enjoyed a robust history of modeling that has illustrated the aforementioned point. Horstemeyer and McDowell (1998) numerically showed that although macroscale continuum rotations in tension or compression still admit lower-length scale rotations, they subtract each other out to make an isotropic continuum material. However, at the grain scale, it is very anisotropic. In simple shear or torsion, Horstemeyer and McDowell (1998) showed that a different rotational rate like the crystal plasticity or texture effect will occur within all of the crystals when compared to tension and compression and will also change the responding stress state. This "torsional softening" occurs when the traction, t, on the outside of the continuum point is a torsional load. If the traction, t, is a tensile load (or compression), the whole continuum will be homogeneous and isotropic, but locally at each length scale, it will be highly anisotropic and rotations will be observed throughout different length scales. If crystal-plasticity models were applied to the universe in a BVP, then we would expect predictions of galaxy cluster rotations, galaxy rotations, solar system rotations, planet rotations, etc.

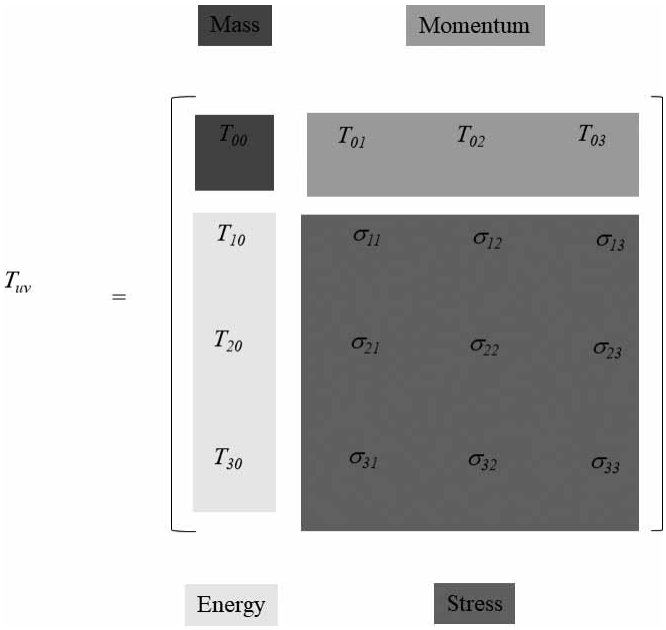
Einstein's General Theory of Relativity

If one could mathematically cast Einstein's (1916; 1922, pp. 54–75) General Theory of Relativity as a form of the governing equations from continuum theory including the constitutive equations, then one could solve the universe's BVP. As a true mathematical corollary, the continuum mechanics equations including Hooke's Law were mapped exactly to Einstein's General Theory of Relativity by Tenev and Horstemeyer (2018a, 2018b; 2019). The General Theory of Relativity (Einstein, 1916) is given by the following,

$$T_{uv} = [c^4/(8\pi G)](R_{uv} - \tfrac{1}{2}Rg_{uv}), \tag{4}$$

where T_{uv} is the stress-energy tensor, c is the speed of light, G is the gravitational constant, R_{uv} is the Ricci Tensor, R is the first invariant of the Ricci Tensor, and g_{uv} is the geometric metric tensor.

The u and v are indicial notation indicators that index from 1 to 4 for four-dimensional space, similar to the i and j for the three-dimensional director vectors used earlier to describe the stress tensor, σ_{ij}. The T_{uv} is called the stress-energy tensor given by the following matrix,



(5)

One can see that the General Theory of Relativity has the stress tensor, σ_{ij}, embedded on the left-hand side of Equation (4) similar to Generalized Hooke's Law in Equation (2) as delineated in Equation (5). Tenev and Horstemeyer (2018a, 2018b) mathematically showed that the right-hand side of Equation (4) is "strain-like" similar to Generalized Hooke's Law in Equation (2). Consequently, the gravitational constant is "modulus like" also illustrated in Generalized Hooke's Law of Equation (2). Note that Equation (5) appears to put together the continuum conservation equations of mass, momentum, and energy and also the constitutive relations. Hence, Tenev and Horstemeyer (2018a, 2018b; 2019) showed that the standard continuum equations can indeed be mapped to the General Theory of Relativity as summarized in Table I. From Tenev and Horstemeyer (2018a, 2018b) the key interpretation is that gravity is proportional to the Laplacian of the strain tensor,

$$\nabla^2\varepsilon \sim c^2 k\mathrm{r}, \tag{6}$$

where ∇^2 is the Laplacian operator, k is the Einstein constant ($= c^4/(8\pi G)$, and r is the density of the matter-energy. Essentially, the General Theory of Relativity in non-Euclidean space can be mapped to Generalized Hooke's Law and the continuum conservation equations. The analysis by Tenev and Horstemeyer (2018a, 2018b) is summarized in Table II.

Since the General Theory of Relativity (Einstein, 1916) shown in Equation (5) encompasses all of the conservation equations (mass, momentum, and energy) and constitutive relations, it only needs Cauchy's Law to be applied to it to represent a full BVP. Hence, FEA (Finite Element Analysis) could be used with the General Theory of Relativity to solve BVPs for the universe. To date, no FEA has been developed nor used in this manner. Regardless, the conclusion arises that *there are traction forces, t_i, on the outside of the cosmos.* Since some "thing" is on the outside of the cosmos, one can assume that the traction forces, t_i, as shown in Equation (3) are God's hands on the outside of the universe. Thus, just like any traction force, t_i, outside of a continuum body can immediately (in a quasi-static sense) influence the internal stress-state in a rigid body and its deformation manner, God's hands influence everything in the space-time-matter universe. The following *evidential* proof is substantiated by the aforementioned work:

1. The continuum mechanics' Hooke's Law and governing conservation equations (mass, momentum, and energy) were correlated directly to the General Theory of Relativity and were shown to be an exact mathematical equivalence by Tenev and Horstemeyer (2018a, 2018b). The stress tensor, σ, is a subset of the energy-stress tensor,

$$\mathrm{T} \in \sigma. \tag{7}$$

Table I. The equivalence of the General Theory of Relativity and standard continuum mechanics equations where $\hbar$ is Planck's constant, and ν is Poisson's ratio.

General Relativity View	Continuum Solid Mechanics View
Physical Space	Solid cosmic fabric
Spacetime	World volume of the cosmic fabric
Gravitational potential Φ	Volumetric strain $\varepsilon = -\Phi/c^2$
Gravitational waves	Shear waves in the fabric
Matter curves spacetime	Matter prescribes fabric strain
Action integral in free space $\mathcal{S} = \frac{1}{2\kappa}\int R\sqrt{\lvert g\rvert}\,\mathrm{d}^4x$	Action integral outside of inclusions $\mathcal{S} = \frac{L^2Y}{24}\int R\sqrt{\lvert g\rvert}\,\mathrm{d}^4x$
Constants of nature: $G, \hbar, c, \quad \kappa \equiv 8\pi G/c^4$	Elastic constants: $Y = 6c^7/2\pi\hbar G^2, \quad \nu = 1$

Table II. Differences that needed reconciliation to equivalence the General Theory of Relativity and standard continuum mechanics equations.

General Relativity	Continuum Solid Mechanics
Four dimensions	Three dimensions
Non-Euclidean Space	Euclidean Space
Curvilinear coordinates	Cartesian coordinates
Bending Boundary Conditions	Uniaxial Boundary Conditions
Curved Space	Straight Space

2. If Cauchy's Law is applied to The General Theory of Relativity (and there is no reason to think otherwise), then the set of equations can be cast into a boundary-value problem (BVP) just like Hooke's Law and the continuum conservation equations and be discretized into smaller continuum points to be used in FEA (this is mathematically a correlation).

Equation (3) + Equation (4) (8)

3. In solving the BVP, traction forces outside of the boundary are required by definition of Cauchy's Law to resolve the changing internal state of the universe.

Note: Equation (5) (9)

Figure 2. The traction force, *t*, in Cauchy's Law represents the hand of God outside of the universe.

4. Since something exists outside of the universe like the traction force, *t*, that something is God by definition. One could interpret the traction force, *t*, as the hand of God that is "existent" and "unique" (Axelsson and Barker, 2001), since it is determined within the context of the BVP. (This is based on Biblical references and is then an assertion.)

Discussion

There are several points that need further discussion related to the aforementioned physics and mathematical evidence for God's existence using the set of equations to formulate a boundary-value problem for the universe. One is the distinction between a boundary value problem and an initial-value problem. Another relates to the question of which part of the Godhead is actively involved as the traction force, *t*, meaning either the Father, Jesus, or the Holy Spirit. Also, the argument that the traction force, *t*, is the hand(s) of God representing the traction force, *t*, on the outside of the universe is an assertion made by the authors but has many Biblical references and inferences.

Since the set of equations, which relate to everything in the universe, are formulated within a boundary-value problem, the traction forces, *t*, are acting in the current state as defined by continuum mechanics and not just in the original reference state. In continuum mechanics, the reference state is the initial state and the current state is what is happening *now* but can include the history of the materials within the continuum body. One can think of the example of the Big Bang Theory as an initial-value problem, whereas one can think of the Designer/Creator God who not only made everything from the beginning but also controls and influences what happens within the continuum body of the universe at every time increment that is *now* as a boundary-value problem. One can also think of the initial-value problem as Deism, where God started things at the beginning and set up all of the laws of nature but does not interact with His cosmos afterward. Alternatively, one can think of the boundary-value problem as related to the Christian God, who not only started the universe but continues to interact within the cosmos.

The physics and mathematical evidence also indicate the local stresses arise from the external forces, whether they are applied in tension, compression, and/or torsion, where the local geometry/structure help determine the local stress like any boundary-value problem found in solid mechanics. Since rotations are observed in the universe at different length scales, we would expect no difference from crystal plasticity considerations from the kinematics (geometry) in the constitutive model [Equation (2)]. From this evidence, we will call the local effects arising from the traction, *t*, long-range transients. These long-range transients do not entail the very personal

aspect of the Holy Spirit interacting with or within a human, which we will call short-range transients. Hence, the long-range transients arise from the boundary conditions outside of the cosmos, whereas the short-range transients arise from the Holy Spirit's motion within the cosmos. Now, it is not clear what part of the Godhead or how the Godhead would be moving upon the outside of the universe: (1) Could it be by the Father's hands, (2) could it be by Jesus's hands, or (3) could it be the work of the Holy Spirit? Currently, the authors, given the obvious uncertainties, believe that it is by the hand(s) of the Father, as will be discussed next.

The authors assert that the Cauchy traction force, f, is the hand of God and most likely that of the Father. Although the "hand of God" might be a Jewish euphemism, it may actually have more direct meaning. Here are the following Bible verses that provide a basis for the long-range transients related to the evidence of God's existence being His hands. 1 Chronicles 29:12 provides the notion that the strength of a material and the power (the time-rate of change of energy) are realized as that coming from the hands of God the Father.

> 1 Chronicles 29:12 (KJV): Wealth and honor come from you (God); you are the ruler of all things. In your hands are strength and power to exalt and give strength to all.

The following Bible verses give the impression at first blush, that God's hands represent a shortrange transient; however, when one thinks about the boundary-value problem in that any force on the outside of the universe can affect immediately the local continuum body at any length scale, then it cannot be dismissed that it also could be viewed as a long-range transient.

> Psalm 8:3 (NKJV): When I consider Your heavens, the work of Your fingers, the moon and the stars, which You have ordained;
>
> Isaiah 48:13 (KJV): My own hand laid the foundations of the earth, and my right hand spread out the heavens; when I summon them, they all stand up together.
>
> Isaiah 40:12 (KJV): Who has measured the waters in the hollow of his hand, or with the breadth of his hand marked off the heavens? Who has held the dust of the earth in a basket, or weighed the mountains on the scales and the hills in a balance?
>
> Psalm 95:5 (KJV): The sea is his, for he made it, and his hands formed the dry land.
>
> Habakkuk 3:4 (KJV): His splendor was like the sunrise; rays flashed from his hand, where his power was hidden.
>
> Job 36:32 (KJV): He fills his hands with lightning and commands it to strike its mark.
>
> Job 12:10 (KJV): In his hand is the life of every creature and the breath of all mankind.
>
> Isaiah 64:8 (KJV): Yet you, Lord, are our Father. We are the clay, you are the potter; we are all the work of your hand.

Summary

This paper documents physics and mathematical evidence for the existence of a currently acting God using Hooke's Law, Cauchy's Law, and Einstein's General Theory of Relativity to develop a boundary-value problem for the cosmos that defines the Cauchy traction force, *t*, to be on the outside of the cosmos. The authors assert that the traction force, *t*, arose and continues to operate as the hands of God that provide external loads, which, in turn, affect everything within the space-time-matter continuum body of the universe. Since the set of equations, which relate to everything in the universe, are formulated within a boundary-value problem, the traction forces, *t*, are acting in the current state (as defined by continuum mechanics) and not just in the original reference state. In other words, the boundary-value problem relates to *now*, but an initial-value problem mathematically relates only to the initial state. The spiritual translation is that the boundary-value problem reflects God's current hand on the universe, but an initial-value problem would have had God's hands on the universe just at the beginning and then just let it go from there without more influence, like deism.

Further corroboration of this idea of connecting the General Theory of Relativity to the continuum mechanics equations of mass, momentum, energy, and constitutive equations (Hooke's Law) gives us different length-scales of rotational entities in the universe. The expectation is that the cosmos would have different length-scale rotational quantities based on continuum mechanics. In fact, it does: galaxy cluster rotations, galaxy rotations, solar system rotations, planet rotations, etc., which arise from the kinematics of crystal plasticity.

The authors also propose that the traction force, *t*, of the universe's boundary-value problem mathematically represents the hands of God holding the universe, so that any squeeze instantaneously brings an internal stress to any location within the universe. Different Bible verses are provided to give a basis for God's hands controlling the cosmos.

The presuppositions related to the evidence are the following:

- Continuum mechanics, which has been experimentally validated on Earth and our solar system, can extrapolate to the whole of the cosmos as it correlates with the Einstein's General Theory of Relativity.
- A boundary-value problem (BVP) with all of the necessary and sufficient mathematical equations applies to the cosmos.
- The Bible is inerrant, so Biblical references argue that the hands of God control the cosmos.

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