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Dr. Mark Horstemeyer is Dean Emeritus, a Distinguished Professor, and a Senior Fellow in the Center for Apologetics at Liberty University. His career spans over 35 years, including significant work at Owens Corning Fiberglas, Sandia National Labs, Mississippi State University, and Liberty University. He holds a B.S. from West Virginia University, an M.S. from Ohio State University, and a Ph.D. from Georgia Tech.

He is highly recognized within the scientific community, holding Fellow status in the American Society of Mechanical Engineers, American Society of Metals, Society of Automotive Engineers, and the American Association for the Advancement of Science. His prolific publication record includes over 600 journal articles boasting an impressive h-factor of over 70 and more than 20,000 total citations. He has delivered over 150 invited lectures worldwide and has mentored more than 200 graduate students and post-doctoral researchers.

Dr. Horstemeyer worked at Sandia National Laboratories (1987-2002), concentrating on systems designs, finite element analysis, structural mechanics, shock wave physics, and multiscale modeling. He was a Chair Professor at Mississippi State University (2002-2018). And he has worked at Liberty University (2019-present)

His research is based on Integrated Computational Materials Engineering (ICME) that was solidified by his foundational books: *Integrated Computational Materials Engineering (ICME) for Metals: Using Multiscale Modeling to Invigorate Engineering Design with Science* (2012), *ICME for Metals: Case Studies* (2018), and *Multiscale biomechanical modeling of the brain* (2021).

Horstemeyer has applied ICME to a diverse range of critical and complex projects. These include the design, simulation, and testing of thermonuclear bombs; large-scale simulations for submarine vulnerability; serving on the Columbia Space Shuttle Accident Investigation Board; conducting simulations of the plane strike on the World Trade Center; designing and simulating automotive components for brands like Cadillac and Corvette; developing simulations for football helmets to prevent concussions; and modeling meteoritic impacts onto the Earth.

Dr. Horstemeyer has received numerous international honors. He was appointed as an Honorary Professor at Xihua University in China (2010). He was invited to serve as an Adjunct Professor at Tuskegee University (2013). He delivered the plenary presentation for the India Institute of Metals and was awarded a Medal of Science recognition from India (2018). The SIPS International Conference in Thailand honored him with a symposium in his name and presented him with the Flogen Fray International Sustainability Award (2021).

In his personal life, Mark and his wife, Barbara, have two children, two grandchildren, and five foster children, along with many kinship grandchildren. They are active members of Thomas Road Baptist Church, and he is a board member for the Creation Research Society.

Mathematical Proof of God's Existence

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Physics with its mathematical equations using Hooke's Law,¹ Einstein's General Theory of Relativity,² and Cauchy's Law of Mechanics³ provide a mathematical proof of God's existence for the first time as a boundary value problem.⁴ This proof herein is NOT a philosophical argument for God's existence based upon cosmological⁵ and ontological⁶ reasons such as those from Socrates to Thomas Aquinas. As such, the physics and mathematical proof herein does not invoke any aforementioned philosophical or logic 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 proof that the Cauchy traction vector,⁷ " t ," operates on the outside of the universe, when the continuum body⁸ is assumed to be the universe. Hence, the traction force,⁹ " t ," represents the hand of God operating on the outside of the universe to influence everything inside of the universe, like " t " does to the internal stress,¹⁰ " s ." Since the mathematical equations provide a Boundary Value Problem and not an initial value problem,¹¹ the activity of the Cauchy traction force, " t ," is acting *now* and not just in the past, thus refuting atheism.¹²

Here is the mathematical sequence:

1. The continuum mechanics Hooke's Law and governing conservation equations¹³ (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,b). The stress tensor,¹⁴ " s ," is a subset of the stress-energy tensor,¹⁵ " T ,"

$$T \in s. \quad (16)$$

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 equations¹⁷ and be discretized into smaller continuum points¹⁸ to be used in a finite element analysis¹⁹ (Axelsson and Barker, 2001), for example,

$$t_j = s_{ij}n_i \quad (20)$$

$$T_{uv} = [c^4/(8pG)] (R_{uv} - 1/2 R g_{uv}) \quad (21)$$

where " n_i " is the unit direction vector,²² " t_j " is the traction vector, and " s_{ij} " is the stress tensor in indicial notation.²³ Where " T_{uv} " is the stress-energy tensor, " c " is the speed of light,²⁴ " G " is the gravitational constant,²⁵ " R_{uv} " is the Ricci Tensor,²⁶ " R " is the first invariant of the Ricci Tensor,²⁷ and " g_{uv} " is the geometric metric tensor.²⁸ Since, 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 vectors²⁹ used earlier to describe the stress tensor, " s_{ij} ."

3. In solving the BVP, traction forces, " t ," outside of the boundary are required by definition of Cauchy's Law to resolve the changing internal state of the universe.

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.

Footnotes:

- 1) "*Hooke's Law*" was published in 1678. The law was first stated as a Latin anagram in 1676 by Robert Hooke (1635 - 1703) who published the solution to the anagram in 1678 as "ut tensio, sic vis" ("as the extension, so the force"). Hooke's Law states that the force needed to stretch or compress a spring is directly proportional to the distance it is moved from its resting position. In simpler terms, the more you stretch or compress a spring, the more force it takes, and the force it exerts back is in the opposite direction. For example, to stretch a spring twice as far, you need to apply twice the force.
- 2) Albert Einstein (1879 – 1955) published his *General Theory of Relativity* in 1916. The final paper, "Die Grundlagen der allgemeinen Relativitätstheorie" (The Foundations of the General Theory of Relativity), was submitted for publication in the journal *Annalen der Physik* on March 20, 1916. His General Theory of Relativity describes gravity not as a force, but as a warping of spacetime caused by mass and energy. The more massive an object, the more it curves the "fabric" of spacetime around it, and this curvature is what we experience as gravity. Instead of an invisible pull, gravity is the result of objects following the curved paths in this distorted spacetime.
- 3) Augustin-Louis Cauchy (1789 -1857), was a French mathematician who made foundational contributions to mechanics, particularly the mathematical theory of elasticity. He is considered one of the greatest mathematicians of the modern era, known for his work on a wide range of topics including calculus, complex variables, and fluid dynamics. "*Cauchy's Law of Mechanics*" (also known as the *Cauchy stress theorem* or *Cauchy's first law of motion in continuum mechanics*) states that the state of internal forces within a material body can be completely described by a mathematical object called the "Cauchy stress tensor." The Law (which involves the development of the general theory of the stress tensor and the Cauchy equation of motion), was first presented in 1822 and formally published in 1823.
- 4) In simple terms, a "*Boundary Value Problem*" is a mathematical problem where you find a solution to a differential equation that fits specific conditions at the "boundaries" or spatial endpoints of the domain. Basically, instead of starting at one point (the initial value) and figuring out the rest, you are given the conditions at the beginning and the end of the problem's range all during the application of the forces. An example would be finding the shape of a bridge by specifying its height at the two ends, rather than being given its height and slope at only one point and then also including the weight of the bridge, the weight of vehicles, and its wind forces.
- 5) In simple terms, a "*Cosmological Proof*" is an argument for God's existence based on the idea that the universe's existence requires a first cause. It starts with an observable feature of the universe, such as its beginning or the fact that things are contingent, and logically deduces that a necessary, uncaused being must exist to explain it.
- 6) In simple terms, an "*Ontological Proof*" is a philosophical argument for the existence of God based on logic and reason alone, without relying on observations of the world. The simplest form argues that God is defined as the most perfect being conceivable, and since existence is a perfection, God must exist because a non-existent being would not be the most perfect.

- 7) In simple terms, a "*Cauchy Traction Vector*" is the force per unit area acting on a surface, encompassing both the force pushing directly on the surface (normal force) and the force sliding across it (shear force). It is a vector because its direction and magnitude depend on the orientation of the surface it's acting on. For a fluid at rest, it simplifies to just pressure (a scalar), but for a solid or viscous liquid, it's a vector quantity.
- 8) In simple terms, a "*Continuum Body*" is a model of a substance that ignores its discrete, atomic nature and treats it as a continuous, unbroken "body" of matter. This is useful because properties like density, pressure, and velocity can be thought of as varying smoothly and continuously at any point within the material, even though the material is actually made of separate molecules.
- 9) In simple terms, a "*Traction Force*" (same as Cauchy Traction Vector) is the push or pull that allows one surface to grip and move another, like the force from a car's tires gripping the road or a cell pulling on its surroundings. It's the force created through friction or shear that causes motion, whether it's a train's engine pulling its carriages or a cell moving during development.
- 10) In simple terms, "*Internal Stress*" is the invisible force or tension that exists within a material. It can also be residual forces left from manufacturing or temperature changes.
- 11) In simple terms, an "*Initial Value Problem*" (as opposed to a "Boundary Value Problem") is a mathematical problem that combines a differential equation with an initial condition, which is a specific value at a starting point. Its purpose is to find a unique solution to the differential equation by using the initial condition to "lock in" the specific solution from a family of possible solutions.
- 12) In simple terms, the statement, "*the activity of the Cauchy traction force, 't,' is acting now and not just in the past, thus refuting atheism*" can be further explained saying the action of the external Traction Force or Cauchy Traction Vector continuously acts throughout time thus reflecting the Hand of God continuously acting upon the universe.
- 13) In simple terms, a "*Conservation Equation*" is a mathematical equation that describes how a physical quantity, like mass, momentum, or energy, stays constant in a system over time. It represents the principle that this quantity is neither created nor destroyed, but can only change forms or move from one place to another within the system. These equations are often written in the form of a continuity equation, which balances the rate of change of the quantity with the amount that flows in or out of a given volume.
- 14) In simple terms, a "*Stress Tensor*" is a mathematical tool that describes the internal forces within a material, including both the normal forces (like tension or compression) and the shear forces (like twisting or sliding) acting on every possible surface at a single point. It is a mathematical 3x3 matrix that captures all the forces acting on an object, representing a complete picture of how the material is being squeezed, stretched, or twisted.
- 15) In simple terms, an "*Stress-Energy Tensor*" is a mathematical representation that describes the density and flow of mass, energy, and momentum at every point in spacetime. It's the "source" of gravity in Einstein's theory of general relativity, just as mass is the source of gravity in Newtonian physics.

- 16) Axelsson, O. and Barker, V.A., 2001. *Finite element solution of boundary value problems: theory and computation*. Society for Industrial and Applied Mathematics.
- 17) In simple terms, a "*Continuum Conservation Equation*" is a mathematical formula that expresses the principle that a physical quantity, like mass, energy, or momentum, is conserved (cannot be created or destroyed) in a continuous material. It describes how this quantity is transported through a system by accounting for its flow in and out of a control volume and the rate of change within it.
- 18) In simple terms, a "*Continuum Point*" is an individual volume at a particular location within a continuous range size scales between two extremes. It's a single spot on a spectrum where each point is only slightly different from its neighbors, but the points at the opposite ends of the spectrum are quite different.
- 19) In simple terms, a "*Finite Element Analysis*" is a computer-based method for simulating how a physical object, known as a structure or a system, will react to real-world forces such as vibration, heat, fluid flow, or other physical effects. It is a mathematical technique used in engineering to solve complex problems that cannot be solved easily with a single, simple equation.
- 20) Horstemeyer, M.F. and Tenev, T., 2024. Physics Evidence for God's Current Existence and Activity Using Einstein's General Theory of Relativity. *Creation Research Society Quarterly*, 60, pp.258-266.
- 21) Tenev, T.G. and Horstemeyer, M.F., 2018a. Mechanics of spacetime—A Solid Mechanics perspective on the theory of General Relativity. *International Journal of Modern Physics D*, 27(08), p.1850083.
- Tenev, T.G. and Horstemeyer, M.F., 2018b. Recovering the Principle of Relativity from the Cosmic Fabric Model of Space. *Reports in Advances of Physical Sciences*, 2(04), p.1850011.
- 22) In simple terms, a "*Unit Direction Vector*" is a vector with a length of 1 that only points in a specific direction, without any magnitude or length attached. It's used to represent a pure direction in space, separate from any sense of distance or force. You can find a unit vector by dividing any vector by its own magnitude.
- 23) In simple terms, "*Indicial Notation*" is a compact way to write complicated equations, especially those involving tensors, by using subscripts instead of writing out all the terms. The core rules are: a repeated index in a term implies you should sum over it, and an index that appears only once in every term (a "free index") must be the same in all terms, representing a separate equation for each value the index can take.
- 24) The "*Speed of Light*" in a vacuum, a universal physical constant denoted by the letter "*c*," is exactly 299,792,458 meters per second.
- 25) In simple terms, the "*Gravitational Constant*" denoted by the letter "*G*" is a fundamental number that determines the strength of the gravitational force between any two objects with mass. It acts as a universal conversion factor, connecting the mass and distance

of objects to the gravitational force they exert on each other in equations like Newton's law of universal gravitation.

- 26) In simple terms, the "*Ricci Tensor*" measures how much a space's geometry deviates from being flat. It represents the change in volume of a small "ball" of space as it is transported along a path compared to what would happen in flat, Euclidean space. Essentially, a non-zero Ricci tensor indicates that matter and energy are present, warping spacetime, while a zero value signifies a vacuum spacetime.
- 27) The "*first invariant of the Ricci Tensor*" is basically just adding up the diagonal terms of the matrix.
- 28) In simple terms, the "*Geometric Metric Tensor*" (often simply called the "metric") is a mathematical object that provides a rule for measuring distances, lengths, and angles in a given space, which may be curved. It essentially defines the intrinsic geometry of that space (or "manifold").
- 29) In simple terms, a "*Director Vector*" is a line segment with a specific direction and length used in engineering and physics to represent the orientation of a material element, like a point on a rod or a shell. It is often used to model things with a directional property, such as the orientation of molecules in a liquid crystal or the preferred directions of anisotropy in a material. These vectors can deform and rotate as the material deforms, so they are a key part of more advanced material modeling.