

Unified Mechanics Theory: Unification of Thermodynamics and Newtonian Mechanics

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ABSTRACT

The field of classical mechanics is based on Sir Isaac Newton's work in "The Principia," published in 1687. In this work, Newton introduced the world to three universal laws of motion, which describe the relationships of any object, the forces acting upon it and the object's resulting motion. It is these three laws that make up the foundation for classical mechanics, and all subsequent theories of mechanics are derived from them. However, Newtonian mechanics still cannot account for the past, present or future of any aspect of a physical body or its governing equations.

Around 1850, Rudolf Clausius and William Thomson (Kelvin) formulated both the First and Second Laws of Thermodynamics. Because the field of thermodynamics governs the past, present and future of all physical bodies, the aging process and life span of any physical system can be modeled in accordance with the thermodynamics laws. Still, thermodynamics alone cannot convey the response of a physical body under an external force at any given moment – something classical mechanics equations are able to achieve.

Over the last 150 years, many unsuccessful attempts were made to unify the fields of classical mechanics and thermodynamics, in order to create a generalized and consistent theory of evolution of life span of inorganic and organic systems. All past attempts to unify Newtonian Mechanics and Thermodynamics were based solely on the use of curve fitting to physical experiments, and empirical models. Unified Mechanics Theory unifies laws of Newton and Thermodynamics using entropy generation rate with following equations,

$$F = m \frac{d[v(1 - \Phi)]}{dt} \quad \text{and} \quad F_{12} = [k_{21}(1 - \Phi)] u_{21}$$

Where Φ is a Thermodynamics State Index (TSI) can have values between zero and one. TSI is directly calculated from the thermodynamic fundamental equation of the system, which includes all entropy generation mechanisms in the material/system, without curve fitting and/or life prediction testing.

Unified Mechanics Theory can predict the degradation, fatigue and fracture of any physical system based purely on mathematical calculations and without the need for testing or curve fitting phenomenological models. In this presentation, recent advances in Unified Mechanics Theory will be presented.

Keywords: evolution, Thermodynamics, Newtonian Mechanics, Entropy, Life Prediction