

The Dialectica Manifesto

***Dialectical Ideography* and**

the Mission of **F.E.D.**

Nonlinearity,
«*Auto-Kinesis*»,
and
Dialectic

Nonlinearity, «Auto-Kinesis», and Dialectic.

If “nonlinearity” is the *root cause* of this mathematical difficulty and “intractability”, and if “nonlinearity” is the *root cause* of this present “closed-form unsolvability”, then what does “nonlinearity” signify?

In its deepest meaning, nonlinearity signifies what Plato called «*autokinesis*» [see below].

;) Differential-equation “nonlinearity” is the mathematical name for mathematical, ideographical, ‘equational’, ‘purely-quantitative’ modeling of ‘self-motion’, of ‘self-motion’, of ‘self-[induced] movement’; of ‘self-induced change-of-state’; of “self-reflexiveness” [cf. Russell], that is, of ‘self-reflexive’, “self-referential” action; of ‘self-reflexiveness’ and of ‘self-reflexive’ action, that is, of action which *flows back to and changes its source*, its *agent*, its *subject* -- and, thus, of ‘self-developing process’, or of *developmentally self-propelling*, ‘self-developing event’!

These equations -- equations that the presently absent, presently-unformulated “‘closed-form’” function-formulae solve -- are called “nonlinear” because, in them, the unknowns [which, for integro-differential equations, are function-unknowns, not single number-values as are the solutions of algebraic, diophantine equations], the *so far unfathomed solving-functions*, appear, with their function-values, or with the values of their derivative-functions, and/or with the values of their integrals, *operating upon themselves*, and/or *operating upon one another*.

■ Such signifies the *dynamical*, i.e., the *time-like* [indeed, the ‘chronogenic’], *interaction and self-interaction* of the underlying actualities that these unknown solving-functions must mime. ■

Linear integro-differential equations, the kind that have for so long been so easily solved by Terran mathematicians, are characterized, in contrast, by function-unknowns which occur in “isolation”, *singly, independently*, without interaction, *operating upon / multiplying neither self nor any other unknown / to-be-solved-for function(s)*.

A typical nonlinear “ordinary” or “total” differential equation is an ideographical ‘state-ment’, that asserts -- that “states”, in effect -- that the instantaneous *velocity of evolution* of the generic, pure-quantitative *value* of the state of the system modeled by that equation for *any*, generic time-value, **t** — the state represented by **x(t)**, thus denoting the *generic state-function-value* of the *dynamical function-unknown to be solved for* — is proportional to a higher power of that unknown, *generic state-value* itself, denoted **x(t)ⁿ**, **n > 1**, i.e., to a *multiplicative self-application / self-operation / self-flexion* or ‘*self-re-flexion*’; to a *self-multiplication*, of that state-value.

Such a ‘*purely-quantitative*’ *self-multiplication* signifies: either **(1)** a [‘*purely-quantitative*’] ‘*self-magnification*’, or; **(2)** a [‘*purely-quantitative*’] ‘*self-diminution*’, of one or more of the values of the state-variable(s) of **x(t)**, for every [‘non-Boolean’] value of the state-variable-value components of that state-“vector” function, **x(t) = x₁(t) + . . . + x_m(t)**.

That state-“vector” function is, in effect, a “list”, or, more precisely, a “non-amalgamative sum”, of **m** “state-variables”, **x₁(t)** through **x_m(t)**, each one reflecting a model-predicted value of a different prime “vital sign” measurement of the system modeled by that state-“vector” function, **x(t)**, as of a given value of **t**. Let us herein call that system as a whole by the name **X**.

Such an equation describes a **system**'s "evolution" as an at least partially '*self-induced*', or '*autokinesic*', *self-driven*, *self-propelling motion* in a *state*-space, or '*space of states*'.

"State Space" an *imagined space*, or *conceptually-constructed space*, in which every *point* denotes a different *possible state* of that **system**, as a "list" of that **system**'s vital signs.

For example, *nonlinear* differential equation models of predator-prey population-count dynamics, or bio-mass dynamics, within an ecological system, often contain a population-size, or bio-mass, *self-limiting Verhulst term* -- a "*self-interaction* term".

This term involves adding in, e.g., a *self-multiplication* of $N_i(t)$, where $N_i(t)$ denotes the *population-count-as-state* of the *i*th species as a function of *time*, **t**, *such that a minus sign is applied to that 'self-product[ion]'*, thus registering as a *negative* contribution to the momentary, "instantaneous" *rate of growth* of that species' *population-count* — where that *rate* of growth is here defined as the metric for the *rate of evolution*, or *velocity of evolution*, of that species' *state* — with respect to time, as the ["continuous"] time "count" advances:

"The *nonlinear correction term* is referred to as a "*self-interaction . . . term*" [which term we also term '*self[-re]-flexive*' ["bent back upon itself"] or '*self[-re]-fluxive*' ["flowing [from self] back to self"] — **F.E.D.**], of the form $N_i(t)^2$. . . where the terms of the form $N_i(t)N_j(t)$, $i \neq j$, *also quadratically nonlinear*, are referred to as "*mutual interaction terms*" [which terms we also term '*hetero-flexive*' or '*allo-flexive*', meaning "other-bent", or "bent by other-than-self" — **F.E.D.**]."

[R. Dutt, P. K. Ghosh, "Nonlinear Correction to the Lotka-Volterra Oscillation in a Predator-Prey System", in **Mathematical Biosciences** [27: 1975], pp. 9-16].

The equations of Einstein's mathematical model of the "universal gravitational field", that is, the equations of his General Theory of Relativity, are *nonlinear* precisely because they must model the '*non-a-tom-istic*', '*self-reflexive*', '*auto-kinesic*', *self-changing 'self-interactivity'* of the cosmos-encompassing gravitic "field" --

"...an *interaction* is *non-linear* if the *total force* exerted by *several bodies* is *not the sum* of the *forces each would exert if acting alone*."

"*Why is the gravitational-inertial interaction non-linear?*"

"The reason is a fundamental one."

"We saw at the end of the preceding chapter that all forms of energy have mass and so act as a source of gravitation and inertia."

"This is true, not only of matter and of light, but also of *gravitational potential energy*."

"We know that this form of energy has a *real physical significance*; it has to be included in a total energy balance . . ."

"*This means that when two bodies act together as a source, in addition to their individual masses we must take their mutual gravitational potential energy as a source*."

"The *total force* is then *not the sum* of the *individual forces*."

“... It follows that the *exact interaction* between [*better, among* — F.E.D.] an *arbitrary number of bodies* is going to have a *complicated form*.”

“Indeed, as we shall see, *it has not been possible to formulate this interaction in an explicit way*.”

“*In consequence, our previous calculation of the total inertial force due to all the matter in the universe is neither strictly correct nor easily correctable*.”

“We can *only hope* that our *linear approximation* gives an answer that has the *correct order of magnitude*”

“In view of all these difficulties, *how was Einstein able to write down a law general enough to specify all the properties of the non-linear gravitational-inertial interaction?*”

“The answer is that he wrote down the *local* properties of the interaction, using the *field* point of view.”

“From this the *global* properties of the *interaction* between [*better, among* — F.E.D.] distant bodies *can be calculated in principle, although in practice no one has been able to do this exactly even for just two bodies*, except in the limit when one of them has a mass negligible compared with the other”

“It is instructive to look at this *self-interaction of the gravitational field* from a slightly different point of view . . . inertial forces act on *gravitational waves* and, if the Principle of Equivalence is correct, so must gravitational forces. . . .”

“This shows *how essential* is *the self-interaction of gravitation*. . . .”

“It is one manifestation of the fact that *gravitation acts on “everything”*”

“We then have *a self-interacting gravitational field* satisfying *a non-linear field law*.”

[D. W. Sciama, *The Physical Foundations of General Relativity*; Doubleday [New York: 1969]; pp. 55-62].

Thus, for the past **300+** years human knowledge and industry have been partially paralyzed and vitiated by a perennial failure to “solve” general *nonlinear* integro-differential equations, that is, to attain the means by which the vast *potential knowledge* that especially the “*laws*” of nature equations among them encode can be explicitly extracted and practically applied.

Key instances of this *incapacity* include --

- the Newton gravity-equations for more than two mutually-gravitating bodies, the Einstein universal gravitational field equations of General Relativity just addressed in the quotation above;
- the Navier-Stokes equations for electro~neutral liquid / gaseous hydrodynamics, and;
- the “*electro-magneto-hydrodynamics*” of the Maxwell-Boltzmann-Vlasov equation for electro-dynamically *non*-neutral, “*magneto-hydro-dynamical*” “plasmas”, e.g., for superheated, *ionized* gases — that is, for the very media in which nuclear fusion reactions, self-sustaining over ‘mega-macroscopic’ spatial and temporal scales, are observed to occur in extra-human nature, e.g., in the central core-regions of stars.