The Dialectica Manifesto

Dialectical Ideography and

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

The Nonlinearity Barrier

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Of course, all of the above *"**un**solvable"* algebraic / diophantine equations may, today, appear to us to be "trivial" to solve, and their solutions may appear all too familiar to us, given that those solutions were all pioneered long ago, by our remote ancestors.

¿But are there still *"**un**solvable equations"* in our own day**?**

¿Are there still new kinds of numbers, beyond the **G** [the **G**rassmann hypernumbers] yet to be discovered, that will provide the *'**ideo-ontological** wherewithal'* -- the ***new kinds of numbers*** -- necessary to ***solve*** such equations**?**

¿Is there yet a new arithmetic, right now on the verge of being discovered / constructed**?**

If Gödel is right, that this *'**dialectic**'* of ***in***completeness / ***un***decidability / ***un***solvability is "inexhaustible"; [***potentially***] "continuable into the transfinite", then there ***must*** still be such.

¿If so, how far has this *'**Gödelian dialectic**'* progressed, to date, in Terran human history**?**

¿As mapped into *the history of the collective human psyche* per its *'**collective**, anthropological /- 'psyche-ological', '''**psychohistorical**''' conceptual* ***readiness-gradient***', how far along into it are we as of today**?**

¿Does our present stage of this *'**Gödelian dialectic**'* have any scientific relevance**?**

And, if there are, today, still, some equational «***insolubilia***», would their solution — garnered by moving into the next higher stage of this *'**Gödelian dialectic**'* — have any ***practical value***, e.g., ***engineering value***; any ***urgent technological application***; any contribution to make to the growth of the society-***productive forces*** of humanity, i.e., any contribution to make to the ***viability***, *'**qualo-quantitative**' **self-productivity*** and ***prosperity*** of the global human species?

▉*Yes to all*. ▉

Indeed, the very equations which formulate this humanity's most advanced collectively-recognized formulations of the so-called *"**laws**"* of nature -- of the ***un***legislated but habitual patterns of natural action -- are generally of the type that is named ***nonlinear*** [***partial***] ***differential equations***.

They also remain, for the most part — especially when they are ***nonlinear*** — chronically ***un***solved by "standard" mathematics, typically a century or more after their first formulation.

They are also often — and without proof — simply declared, by "standard" mathematicians, to be, not just 'so far unsolved', but [***forever***] "unsolvable" in "exact" or "analytical" or "closed" "form".

This conclusive-sounding phrase is actually anything but.

It merely means that their solutions apparently cannot be expressed in terms of the "elementary", or fundamental, "algebraic" and 'trans-algebraic', or "transcendental" functions or operations ***currently recognized as such*** -- as "elementary" -- even if their solutions ***can*** be expressed in '''open form''', involving [***potentially***] "***infinite*** sums", i.e., [***potentially***] "***infinite*** series" or [***potentially***] "***nonlinear to the infinite degree*** polynomials" — ever improvable approximators — made up out of finite and "closed-form" terms.

The "unsolvability", or so-called "non-integrability", of these ***nonlinear differential equations*** may also mean that the "integration", or solution, of these equations encounters zero-division "***singularities***", which apparently lead to "function-values of ***infinite*** magnitude", so that their solution "diverges" or attains "***infinite***" or "undefined" / "indeterminate" values corresponding to ***finite*** values of the time parameter; that the "**limit**" of their "***infinite*** series" sums, forming their integrals, appears to be without [finite] quantitative limit; appears to be ***quantitatively*** "**limit**less" or '***un***-**limit**-ed'.

This '''***Nonlinearity Barrier***''' of modern, "standard" mathematical science massively blocks this humanity's capability for further scientific and technological / engineering advance around its entire perimeter with the ***un***-known; with its present '***un***-knowledge', viz. --

"That is the way I explained non-linearity to my son."

"But, why was this so important that it had to be explained at all?"

"The complete answer to this question cannot be given at present, but some people feel that the answer, if known, would shake the very foundations of mathematics and science . . ."

". . . practically all of classical mathematical physics has evolved from the hypothesis of linearity."

"If it should be necessary to reject this hypothesis because of the refinements of modern experience, then our linear equations are at best a first and inadequate approximation."

"It was Einstein himself who suggested that the basic equations of physics must be non-linear, and that mathematical physics will have to be done over again."

"Should this be the case, the outcome may well be a mathematics totally different from any now known."

"The mathematical techniques that might be used to formulate a unified and general non-linear theory have not been recognized . . ."

". . . we are now at the threshold of ***the nonlinear barrier***.**"**

[Ladis Kovach; "Life Can Be So Nonlinear", in American Scientist [**48**:**2**, June **1960**], pp. **220**-**222**, ***emphases added*** by **F.E.D.**].

No less than ***the founding problem*** of modern, ‘‘‘mathematico-science’’’ — a problem that was also a central focus and motivation of ancient science — today takes the form of a system of ***nonlinear integro-differential equations*** which have, to this day, in both their Newtonian and Einsteinian, General Relativistic versions, remained essentially unsolved [the ingenious **1991**, slow convergence, “open-form”, ***singularity***-“***infinitely***”-***delaying***/***evading*** i.e., planetary-collisions-***infinitely-delaying***/***evading*** — series solution by Qiu-dong Wang notwithstanding], because of their ***nonlinearity***.

This ***founding problem*** is the fundamental problem of astronomy, the problem of the mutual-determination, **including the other**-objects-mediated-***self***-determination, of the motions of celestial objects, when any more than two such objects are admitted into the mathematical model of the celestial cosmos:

“The **n**-body problem is the name usually given to the problem of the motion of a system of many particles attracting each other according to Newton’s law of gravitation.”

“This is the classical problem of mathematical natural science, the significance of which goes far beyond the limits of its astronomical applications.”

“The **n**-body problem has been the main topic of celestial mechanics from the time of its inception as a science.”

“The fundamental dynamical problem for a system of **n** gravitating bodies is the investigation and pre-determination of the changes in position and velocity that the [bodies] undergo as the time varies.”

“However, ***this is a complex non-linear problem whose solution has not been possible under the present-day status of mathematical analysis*.”**

[G. F. Khilmi, ***Qualitative Methods in the Many-Body Problem***, Gordon & Breach [**1961**], page **v**., ***emphases added*** by **F.E.D.**].

Indeed, the models of nature that modern mathematical science has favored are profoundly flawed and misleading in crucial aspects of their ‘descriptics’ of nature, due to ***this specific*** inadequacy of the mathematics that Terran humanity has evolved so far:

“It is an often-stated truism that ***nature is inherently non-linear***.”

“***Biological systems*** particularly ***are full of*** . . . ***non-linearities*** . . .”

“The reason that we go to the trouble of building ***linear*** models when we are really interested in ***non-linear systems*** is that we then acquire the power to evaluate the dynamic performance of the system ***analytically***. . ..”

“In fact, we can ***analytically*** solve for the response of a ***linear system*** to any conceivable input function, however complicated.**”**

[Bernard C. Patten, ***System Analysis and Simulation in Ecology*** [**volume I**], Academic Press [NY: **1971**], p. **288**, ***emphases added*** by **F.E.D.**].

However, in the ***non*-*linear*** domain:

"In general, the ***analytical study of non-linear differential equations*** has been developed only to a very limited extent, owing to the ***inherent mathematical difficulties*** of the subject.

There does not exist, in this field, a suitable technique for attacking ***general non-linear*** problems as they arise in practice.**"**

[John Formby, ***An Introduction to the Mathematical Formulation of Self-Organizing Systems***, Van Nostrand [NY: **1965**], p. **115**, ***emphases added*** by **F.*E*.*D*.].

General non-linear integrodifferential equations cannot presently be solved in "closed form", because the [‘‘‘elementary’’’] functions that would solve them have so far, for the most part, "resisted" discovery and formulation within the extant tradition of Terran human mathematics:

"... ***the assumption of linearity*** in ***operational processes*** underlies most applications of ***analysis*** to the problems of the natural world."

". . . ***Nature***, with scant regard for the desires of the mathematician, often seems to delight in formulating her mysteries in terms of ***non-linear systems*** *of equations* . . ."

" . . . ***the theory of functions*** . . . ***has been developed largely around classes of functions in which the linearity property is an essential factor*** . . .

. . . ***most non-linear equations define new functions*** whose properties have ***not*** been ***explored*** nor for which tables exist...**"**

[Harold T. Davis, ***Introduction to Nonlinear Differential and Integral Equations***, Dover (NY: **1962**); pp. **1**, **7**, **467**, ***emphases added by*** **F.*E*.*D*.].

In the light shed by the foregoing statements, the oft-decried ‘‘‘***mechanistic***’’’ bias of modern mathematics, and of modern science in general, is seen in altered perspective.

This new perspective is strengthened by the observation that the more ‘***organitic***’ and "***organismic***" qualities of ***Nature***, which classical "***mechanism***" / ‘***linearism***’ excludes — phenomenologies such as those of ***non-equilibrium*** and [meta-]evolutionary [meta-]dynamics; of ***holistic***, ***synergistic***, "whole-more-than-sum-of-parts" self-organization; of the qualities of self-determination and self-development, and of sudden and qualitative ***self*-change** — find a native and potent expression in the ***non-linear*** domain.

It thus emerges that science has been ‘‘‘***mechanistic***’’’ only to the extent that it has failed to be ***scientific*** enough — failed to be ***empirical*** enough, or true-enough-to-observation/-experience.

Mathematics has been ‘‘‘***mechanistic***’’’ and ‘***linearistic***’ only to the extent that it has failed to be ***mathematical*** enough.

Modern science and applied mathematics have fallen short of a more adequate description of experiential / empirical truth through suppression or neglect of the immanent truth already enshrined within themselves.

Not even scientific mechanics itself is truly ‘‘‘mechanistic’’’:

“. . . ***Mechanics as a whole is non-linear***; the special parts of mechanics which are ***linear*** may seem ***nearer to common sense***, but all this indicates is that ***good sense in mechanics is uncommon***.”

“We should not be resentful if materials show character instead of docile obedience.”

“. . . ***Although mechanics is essentially non-linear***, it is little exaggeration to say that ***for 150 years only linear mechanics and its mathematics were studied***.”

“It became ***standard*** practice, after deriving the equations for a phenomenon, to replace them at once by a ***linear so-called*** “approximation”.”

“It would be wrong to regard ***this mangling*** as being in the original tradition of mechanics...**”**

[C. Truesdell, “Recent Advances in Rational Mechanics” in ***Science*** [**127**: **3301**, **04** April **1958**], p. **735**, ***emphases added by*** **F.*E*.*D*.].

Closed-form-function solutions for our ***nonlinear***-equation-expressed so-called “laws” of nature would provide ready-calculation of ***global solutions***, for the total domain of initial conditions.

A “computer simulation solution” or “numerical solution” — the only kind of “solution”, if any, presently available for most of these ***nonlinear*** “laws” of nature — merely “simulates” ***some*** of the implications of the ***un***solved equation, and is limited to a single solution-trajectory or solution-history, from a single initial condition, a single “point”, or “***starting state***”, leaving all other ***starting points un***solved-for.

Such simulation-“solutions” also suffer severe limitations of computer calculation time [computation-speed] and storage capacity [memory space], as well as all of the limitations of the computational and “qualitative” [in-]accuracy of “numerical” algorithms, particularly with regard to the detection of “***essential***” ***singularities***.

¿Could it be that what is really brewing here -- in this protracted, chronic, centuries-spanning failure of modern science to solve its primary “laws-of-nature” equations -- is another ‘Gödelian Crisis’; a crisis of the Gödelian-incompleteness and diophantine-equation-unsolvability of these “laws-of-nature” equations within the *de facto* most advanced axiomatic system of arithmetic /-algebra**+** that is so far extant and that is presently in use for all attempts to solve these equations**?**

¿Could it be that what is required to make these equations solvable is, precisely, a new, unprecedented ‘ideo-ontology’ -- new comprehension axioms; new, higher logical types of sets of ordered pairs, or of ordered **n**-tuples; ***new kinds of numbers*****?**

Many prevalent presumptions militate against “***yes***” answers to the questions above.

Unlike what is the case with ***algebraic equations***, ***differential equations*** require more than ***individual numbers*** to solve them. ***Differential Equations*** require ***functions*** -- ***functions*** of the time-variable, **t**, in the case of ***dynamical differential equations*** -- e.g., whole ‘‘‘***continua***’’’ of individual numerical values -- to solve them.

Moreover, ***differential equations*** belong to "***analysis***", not to "***algebra***".

It thus does not seem, at first glance, that ***any*** [***system of***] ***nonlinear differential equation***(***s***) could be represented by any algebraic, diophantine equation, the assertion of whose unsolvability would constitute the deformalization of the incompleteness-or-inconsistency-asserting Gödel Formula immanent to any "Natural"-arithmetic-or-more-encompassing axioms-system.

But the fruition of ***dialectical***, ***immanent critique*** typically requires far more than first glances.