Nonlinearity very simple

I am writing this article because the term **nonlinearity** is often used to describe things that are not actually nonlinear. Many times, instead of simply admitting "I don't know why it works this way," people call the behavior patterns in data as a *nonlinear phenomenon*. Let me explain, very simple, what **nonlinearity** really means — and which modules in Timing Solution software are designed to detect and analyze true nonlinear effects.

In 1972, the American mathematician and meteorologist **Edward Norton Lorenz** posed a now-famous question in his paper: *"Does the flap of a butterfly's wings in Brazil set off a tornado in Texas?"* A decade earlier, nobody would have asked such a question — a butterfly's wing-flap and a tornado belonged to completely different scales of physical phenomena. What has changed? Why did this question suddenly stop sounding absurd in 1972?

As Hegel wrote, **"Destiny comes dressed in the clothes of occasion."**

In 1961, Lorenz used a computer to simulate weather patterns. Getting ready to continue the experiment the next day, he printed the current state of the model — twelve parameters such as temperature, wind speed, and so on — and manually typed these printed values back into the machine. To his surprise, the weather pattern the computer began to predict was completely different from the previous run. The culprit was a tiny rounding error in the printed output. The computer internally used six-digit precision, but the printout rounded each variable to three digits. A value like **0.707777** appeared on paper as **0.708**. This difference is microscopic, and at the time the consensus was that such a small change should have no practical effect. Yet this is how Lorenz discovered that **small changes in initial conditions can produce large changes in long-term outcomes**.

This is how chaos theory emerged: it became clear that inputs and outputs are not always proportional. A small change in initial conditions can produce a vastly disproportionate outcome — so, in theory (and only in theory), a butterfly's wing-flap could set off a tornado in Texas.

Chaos theory very quickly became popular, influencing physics and then practically every branch of science, even literature. By the late 1980s it had shaped an entire intellectual mood, offering a new way to explain the world's complexity and how such complexity emerges. Military strategists were also fascinated: where exactly should the butterfly flap its wings to set off a tornado in some specific place on Earth???

When we analyse the stock market today, we do it in a completely different way than half a century ago. A tiny event does not mean it is unimportant; through a domino effect its impact can be amplified tremendously.

How can we handle nonlinear phenomena in Timing Solution? The first tool is the Neural Network (NN) module: its hidden layers allow the construction of highly complex nonlinear models.

In this class you will find an explanation of how nonlinear effects are modeled by the NN module:

https://timingsolution.com/TS/Articles/bb_vs_nn/bb_vs_nn.htm

In that example, the NN models an artificial dataset where the effect of Moon phases depends in a nonlinear way on whether Mercury is direct or retrograde. Standard regression models cannot solve this task; only a neural network can capture such nonlinear interactions.

In practice, we have not found any specific nonlinear effect in stock market data. Using deep-learning neural networks gives some improvement in the projection line, but the improvement is not significant.

I recommend treating nonlinearity as a kind of “finger of God” pointing toward something new — and that “something new” is always different from what we expect. Nassim Nicholas Taleb’s concept of the Black Swan expresses exactly this idea.

Maybe some hints come from astrology (apologies to academia). Pay attention when slow planets enter the signs of the Zodiac — the Phenomena module in Timing Solution shows this clearly. Usually something happens at those moments: