New Systematic Solution for Nonlinear Dynamic Systematic Problems in Modern Science

Deok soo Cha (chdsoo@hotmail.com)
Soongsil University
Hee jong Jun
Soongsil University

Research Article

Keywords: Nonlinear dynamics, Indeterminism, MATLAB, Control theory

Posted Date: December 18th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-122307/v1

Abstract

The reason why modern science is stagnated the development of physical science is unable to solve nonlinear systematic problem; moreover, the physical science's development reached to saturation. However, modern science has no perfect systematical solution for the nonlinear dynamic systematic problem. This study presents a new solution, which has completed by coordination with physics and engineering such as an interdisciplinary study. Therefore, physicist can be solved the nonlinear dynamics using both solution logical solution and systematic solution but it has no problem. Although, physicists cannot deny the validity of new solution itself but they cannot understand the other science such as control theory; hence, they do not welcome it and reject it. However, there is no problem because all scientists wait for a time until physicists master the control theory if physicists agree with its condition, the new solution discloses first and verify after. It will be contributed and development of physics.

1. Introduction

This research paper will present to physicists and non-physicists an advanced systematical solution for unsolved nonlinear dynamic systematical problems in modern science. It will be very interesting to the reader because the readers have not ever seen it before. Meanwhile, the author has a question about modern science. Although engineering technology and other science have made phenomenal advances, but modern physics have been delayed and stagnated in the 20^{th} century. No one answer about the reason. Recently, the author has come to understand the reason that it is saturated the development of deterministic physics. In addition, they have not yet been solved the nonlinear dynamic systems involving complexity. [1]

Unfortunately, the old chaos theory in statistical physics is not perfect and vague and difficult, but it is not systematical solution but logical solution. However, it hinders the development of physical science, ironically, no physicists who understands this problem for themselves; this is unfortunate for physicists. There are many evidences; many students no longer want to learn physics, further, the level of technology and the gap between countries are getting narrower and research expenses are gradually increasing. As a result, the importance of the physical science was lowered, as well as, the treatment of physicists is getting lower. However, they have no idea about the issue, or they are unaware of the problem in foundation of physics. Nevertheless, no one need to worry about this problem, the author has clarified the problem, this study would be presented an advanced solution as below. [3]

(Solutions) The established foundation of physics is solved nonlinear dynamics through statistical mechanics based on determinism such as chaos theory, moreover, no one has a doubt about the basic physics. In 2015, the author has found a serious problem in the basic science. Surprisingly, all physicists have been misunderstood that the old chaos theory in statistical physics is a perfect systematical solution for nonlinear dynamics. However, it is never a systematic solution but a logical solution. Hope physicists keeping in mind it. However, the author believes the reason why the development of today's physics has been stagnant. But there is no problem at all because physicists will newly introduce the new

system analysis theory into modern science. Surprisingly, the author has found a perfect systematical solution [3] based on non-physical science such as technological science and published in 2015 [4]. More detail, it is described in Section 2.

The new solution is completed to coordinate and combine with physics and engineering science such as ‘systems analysis theory’ in control theory [2] as shown in Figure 1(a). [Remark; it has not used in physical science; control theory is developed for designing automatic systems by engineers in the 20^{th} during Second World War. This is as difficult discipline as chaos theory, so computer including MATLAB as shown in Figure 1(b) is an essential equipment; moreover, Figure 1(d) is behavior of its input and output. Further, the result can be verified new solution using analog simulator as shown in Figure 1(c).

(Issues) Unfortunately, physicists have no coordination and cooperation with engineering science, so they did not know and study control theory at all because it is outside of in deterministic physics. Paradoxically, if classical physicists such as Newton coordinated or cooperate with them, these unsolved problems already have solved entirely. Nevertheless, they have no problem because an advanced perfect solution has actually emerged in this paper. Therefore, physicists have no choice because they have been sought solution for long time; moreover, all physicists have long hard work in various ways for a hundred years to solve nonlinear dynamics, but now physicists no need to hard work. Therefore, physicists have no reason to reject the new solution as an interdisciplinary achievement. Similarly, it is like medieval surgeons dividing into physicians and surgeons emerging x-rays; but it is a reasonable idea. Nevertheless, there is a serious problem happened. Many physicists did not trust the validity of author’s research and do not welcome it, why do they do it? Because they are afraid of the validity of new solution. However, it has no problem. Although they do not want to reject the new solution as an interdisciplinary study, the author suggests requirements as below;

(Requirements); 1) while it is not only completed based on the control theory textbook, but also proved through a specially designed simulation, so no one can doubt it; To prove the results, the author provides application examples in Appendix; ‘Random walk’ and ‘Logistic curve’; 2) in the other hand, not all physicists understand the theory of control at all, so all scientists decide to wait until they finish learning; 3) to push physicists to learn of control theory, the author will first publish it and after verify if the research result is incorrect and it will be withdrawn; 4) if need to verification, the author provides the simulation device to public organization (ex; Santa Fe Institute); 5) it is a reasonable idea because no damage or loss to the reader. Hence, if all physicists are agreed the requirements as above, it will be successful in the future.

2. Materials And Methods

2.1 Historical Background

Meanwhile, this study is an innovative research result, which is coordinated with engineering science and physical science control theory, but physicists has not ever been seen it before. This study will describe to divide inro two part for the readers.

n In modern science, there are many unsolved difficult problems in science such as quantum mechanics or weather system, food chain remined. They have three very significant properties, which is not measurable, reversible and reproducible, further, it has nonlinearity and unstable dynamics. In current physics, these nonlinear dynamics has been solved by logical solution in statistical physics based on determinism such as chaos theory. Surprisingly, it is a mistake! Accordingly, all scientists have been misunderstood the chaos theory in statistical physics as perfect systematical solution. What is the problem in it?

In 2015, the author has found a serious problem from modern science. Meanwhile, scientists are divided physical phenomena into linear static logical problems and nonlinear dynamics systematical problems, but determinists have solved both logical and systematical problems together using the same logical solution such as chaos theory in statistical physics. it is mistaken as contradiction. Why do they it? Because there is no perfect systematical solution in deterministic physics. Unfortunately, chaos theory including butterfly effect in statistics physics is a logical solution, moreover, very imperfect, further, vague and difficult to other scientists. Most scientists misunderstood it as a systematical solution. It is like surgeons treat internal medicine patients with surgery, so we need internal medicine doctor.

n On the other in future, we have no problem. This study will present a new systematical solution [3] to physicists in Section 2. It is entirely different from the old chaos theory in statistical physics based on determinism as presented in Table 1 but the reader should not forget a reason; no one need not to replace the old solution and exclude from current physics. Therefore, physicists have obtained two solutions the old and new solution for their discipline such as Al designing or macroeconomics or social systems or etc. It is the same as dividing the medieval surgeon into a surgeon and physician with the emergence of x-rays, similarly, it is coordinated physics and engineering science for solving nonlinear dynamic problems. Therefore, physicists have no choice if physicists want to get out from stagnation of physics' development. Ironically, it will avoid the physicists' hard work for solving nonlinear dynamics.

Table 1: comparison of the logical solution and systematical solution

Division	Present Physics Logical solution	Future Physics Systematical solution
Paradigm	based on Determinism	based on Determinism +Indeterminism
Logical Problem	Solved by Algebra	Solved by Algebra
Systematical Problem	Solved by Chaos theory	Solved by Systems Analysis Theory

2.2 Scientific Background

(In present solution) In modern science, the old chaos theory in statistical physics is a logical solution based on statistics and algebra; there is nothing to study the scientific background of the current theory, but it must be examined again the basis of the old solution such as butterfly effect. On the other hand, most determinists who are not familiar to the systems analysis theory in engineering science. Therefore, no physicists know the reason why it creates nonlinearities from closed loop systems with feedback.

(In future solution) To help physicist understanding, this study will describe the reason. Please the readers note the closed loop system as shown in Figure 2(a)~(c). First of all, we need to understand the internal mechanism. If the function Q(s) is a positive element such as buyer in stock market, as well as, the negative feedback H(s) is a negative element such as seller in stock market, and the amount Y(s) is converged zero state. In this case, we can define as closed loop systems as shown in Figure 2(a ~ c). Moreover, we can classify the feedback systems into three type feedback system as shown in Figure 2(a)~(c).

We need to note that any type physical problems can be converted into block diagram as shown in Figure 2(a ~ c), the readers keep in mind it. Readers pay attention to the description; it is very significant problem for physical science. In case of type (a), it has not systematical problem. It is a logical problem because it has not feedback element. [H(s)= 0] It must be solved by deterministic physics. Likewise, type (c) is determined as an oscillation system like an oscillator; it can be easily solve using algebraic logical solution. Therefore, all physical phenomena are classified into logical problem as type (a) and systematical problem as type (b). In case of type (b), it is 0 <H(s) <1.

Unfortunately, it cannot solve the logical solution based on determinism, moreover, chaos theory is one of the logical solutions. Therefore, if physicists do not want to learn the control theory, they encouraged to be supported from package program MATLAB. If determinists can be simulating the system through the program, they can observe the behavior of output of Figure 2(b), it is extremely fluctuated endlessly and included irregularities, periodicity, self-organization and initial phenomenon

2.3 How to Solve Nonlinear Dynamics Based on Control Theory?

Generally, in modern science, deterministic physics has not dealt with only logical problem, it must be measurable, reversible and reproducible. Therefore, determinists have solved nonlinear systematic problems using logical solution based on statistics such as cha so theory. On the other hand, in new solution, it is very difficult and complicatedly the solution than chaos theory. The control science is a newest discipline and like physics and economics. However, it is regular science, which is not easily accessing, so it is unreasonable to list and describe the main equation here.

Where, [s] is Laplace operator, F(s); transfer function, Y(s); output, U(s); input, G(s); positive element, H(s); negative element.

Accordingly, the final goal of discipline is to mathematically analyze the following transfer function of the closed loop system as shown in Figure 2(b), and to estimate its stability and nonlinearity. Therefore, even a physicist can never understand without learning. For example, if someone, who want to solve the food chain of the ecosystem mathematically, must solve the steps of 1) system modeling – 2) computer simulation – 3) verification – 3) return, and they must be familiar with the program MATLAB used here. If necessity, the readers please refer to the reference [4]. Further, this study presents two application examples in Appendix, hope the readers reading carefully

3. Results

- There is an indispensable problem for the development of lagging and stagnant physics today; it must be solved nonlinear dynamics in modern science.
- For this, this study presents an advanced systematical solution; it was completed with the coordination with physics and engineering like an interdisciplinary study.
- The author encourages physicists to share both new solution and existing chaos theory. Therefore, it is revolutionary scientific result.
- In order to help physicists understanding the solution, we will first disclose it, after verify it, further, we will wait until physicist's finish learning the theories.

4. Discussion

Meanwhile, there are many unsolved difficult problems in science such as quantum mechanics or weather system, food chain and organisms in ecosystem, etc. Why cannot physicists solve the nonlinear dynamics? Because they cannot solve the non- measurable, non-reversible and non-reproducible problems in modern science; in common, it has nonlinearity and unstable dynamics. However, most physicists have been misunderstood it as algebraic logical solution based on determinism, it is like a surgeon treat an internal patient with surgery. This study provides a new systematical solution as mentioned above. Unfortunately, most physicists do not welcome it because they have not ever seen it before, moreover, it cannot easily understand the solution. But there is no problem.

Firstly, as mentioned in Section 1. Instruction, no one can deny or object the validity of the new solution, which is completed based on coordination with physics and control theory. Since it is an interdisciplinary achievement between physical and engineering science. If physicists deny the validity without reason, it is a nonsense. The other word, they have no reason to reject the validity of solution without reason. On the other side, if most physicists cannot understand the new solution concretely, the reason is not only they have not experience about the engineering science before, but also, they have no learning about control theory at all. It is like a surgeon who has no information about x-ray and do not know its effective utility. If so, we need to wait for a time until surgeon masters the x-ray about a year. Summarizing the above descriptions; 1) no one can deny or reject the above solution due to this interdisciplinary

achievement, 2) all physicists decide to wait until they finish learning the control theory; Finally, the author wishes to establish the new solution in foundation of physics.

5. Conclusions

This study presents a perfect systematic solution for nonlinear dynamics, which was unable to solve for the past hundred years; but it has no problem. This study is clarified the problem as above. Thus study presents a new solution which has completed by other science such as systems analysis theory from control theory; moreover, it has proved by a special system simulator, hence, no one can doubt it. Meanwhile, the solution has completed to coordinate and combination with physics and engineering like an interdisciplinary study. It is a revolutionary achievement for modern science. Unfortunately, most physicists have misunderstood that it is very disadvantage to them and do not welcome it because they have no experience and knowledge about the control theory at all. However, it has no problem, all scientists will wait for a time until physicists are mastered learning control theory. If they agree with this above suggestion. It will be completed and is established in foundation of physics, further, modern science gets out from stagnation of development.

Appendix

A. Application Example: Redefined Random Walk [6] in Stock Market

- (Hypothesis) Physicists in Wall Street talked about prediction of stock, it is a random walk. In case of stock market like thermodynamic system. While the positive entropy of seller desired to sell high price is defined Q(s), and the negative entropy of buyer desired to buy low price is defined H(s) as shown in Figure 1(c). The two elements are inversely related to each other and the amount of output converges to zero state by time. (Remark; it is the same as heat in thermodynamics.) If so, we can define the correlation with Laplace transform based on systems analysis theory as Equation (1). It can be defined Figure 1(c) is an internal structure of stock market.
- (Simulation) It can be easily solved and proved the above hypothesis using computer program MATLAB or specially designed analog simulator as shown in Figure 1(a). In this case, the readers must pay attention to the damping factor β in Equation (1) which depends on the item of stock; it is not different from every stock. Usually, the nonlinear dynamics are determined by the factor. If it is less than 1, it is fluctuated price as shown in Figure 3(c). It is the same as random walk, so no one except physicists say it that way. Unfortunately, they have no knowledge with systems science such as control theory. In addition, if the information of stock price is disappeared, the stock price converges to zero by time. Paradoxically, if we cannot know both damping factor and the stock price information from outside, hence, no one can predict the daily final price. [6] Therefore, daily stock price is a representative systematic problem. Hence, there is no existed random walk.

B. Application Example: Redefined Verhulst's Logistic Curve

- (Hypothesis) It was asserted by the mathematician Verhulst, and it explains the increasing and decreasing population to follow [S] curve as shown in Figure 3(a). It can prove through food chain in ecological system using the above solution. While the number of individuals of predator and prey in food chain are defined Q(s) and H(s) in Figure 1(b). Each element is laid inversely and the amount converges to equilibrium by time. In this case, we can define the correlation as Equation (1). It can be easily solved by computer program MATLAB.
- (Simulation) If the damping factor is close to zero without any restriction, the output of population is determined the Equation (2) is sinωt ; it is a sine curve with periodicity as shown in Figure 3(b. It will be continued repeatedly increasing and decreasing to follow S curve. Thus, if someone draw the result without dimension, we can obtain the logistic curve in Figure 3(a). Paradoxically, if he has known the systematical solution, he did not make the assertion. It can be easily reproduced the sine curve through the simulator.

Declarations

Acknowledgments: Eho technology co. research center supported research

Conflict of interests: there is no conflict of interest

Contribution; Cha is conceptualization. Jun is specific verification

References

1. Casti, J. L., 1995. Complexification: explaining a paradoxical world through the science of surprise. Harper Perennial. (1995) DDC 003.7 21 ISBN 0060925876
2. Golnaraghi, F. and Kuo, B.C., 1998. Automatic Control Systems, 10th Edition, McGraw-Hill Education 2017, ISBN-10: 1259643832
3. D.S, Establishment of New Solution for Complex Systems in Multidisciplinary Science Based on Feedback System Analysis Method and Proven by Simulator, Open Journal of Modern Physics. ISSN Print: 1927-1934 DOI: 10.4236/jmp.2015.613198 https://www.scirp.org/journal/paperinformation.aspx?paperid=60738
4. Cha, D. and Jun, H. (2020) The Origin of Nonlinear Dynamics Involving Complexity in Modern Sciences. Open Journal of Applied Sciences, 10, 654-662. doi: 10.4236/ojapps.2020.1010045. https://www.scirp.org/journal/paperinformation.aspx?paperid=103755
5. MATLAB; https://kr.mathworks.com/support/learn-with-matlab-tutorials.html?s_tid=srchtitle
6. Random Walk https://mathworld.wolfram.com/RandomWalk.html

Figures

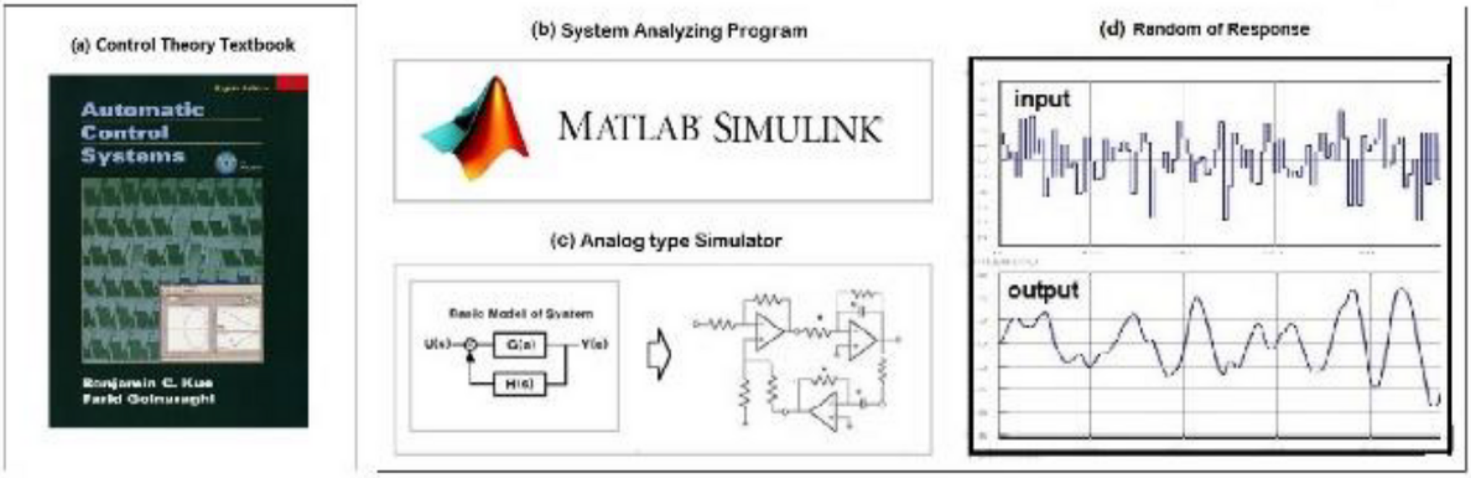

Figure 1

(a) Textbook on Control theory (b) MATLAB Simulink (c) Analog type simulator internal circuit (d) Example of Simulation Result of MATLAB

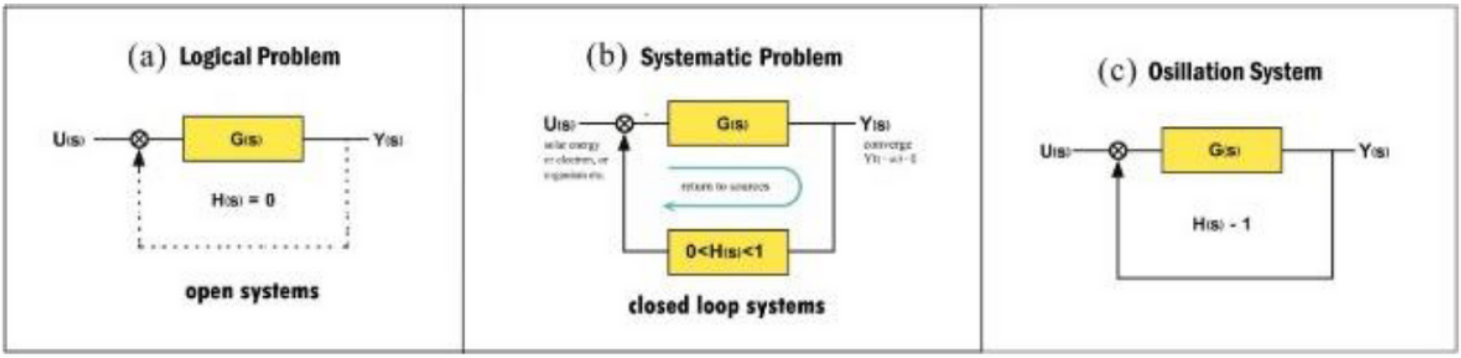

Figure 2

Typical feedback systems are classified into three type. Where [s] is the Laplace operator, the positive entropy is Q(s), the negative entropy is H(s), and every feedback system's transfer function is $F(s)=G(s)/(1\mp G(s)H(s))$, illustrated for the cases of (a) is H(s) = 0, (b) is 0 < H(s) < 1, and (c) is H(s) =1

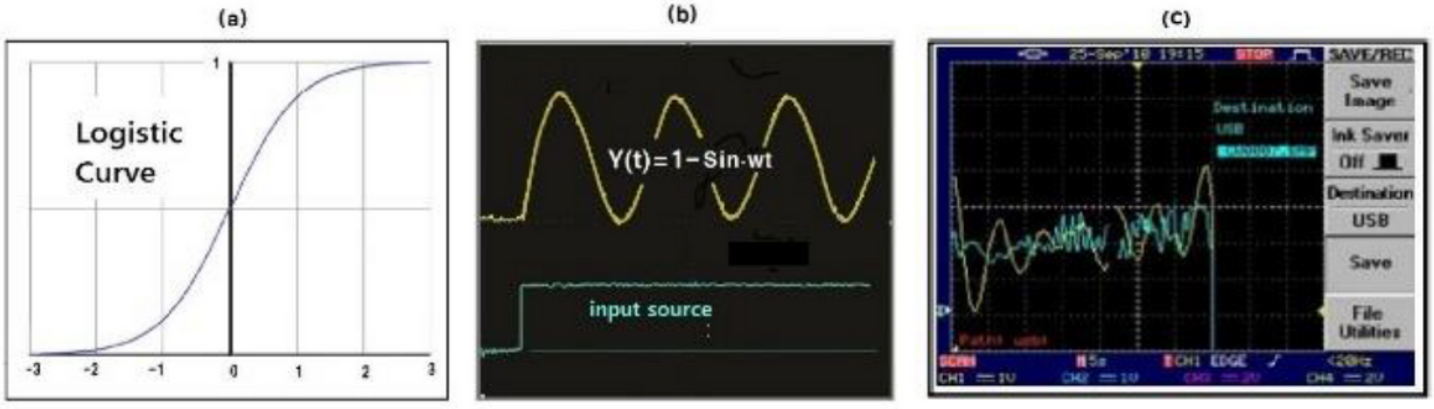

Figure 3

(a) Logistic curve (b) The basic response of constant function – it has a periodicity such as sine curve (c) The examples of practical response output; it is like daily stock price