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Editorial

Editorial for the Launching of Dynamics

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Nowadays, the subject of studying system dynamics behavior has become very important in many branches of technology. The continuous rise of engineering's dominant position in our daily lives has caused a unifying trend among the traditional branches of dynamics from which it has come.

But what is dynamics?

Dynamics is the study of how things change with time and, consequently, concerns the study of the forces that cause them to do so. Therefore, in this period, with the rapid development of technology, the analysis of the dynamic behavior of physical, chemical, and mechanical systems has become a cornerstone of modern technology. Additionally, the complexity of modern engineering systems and the interoperability of their subunits call on us to answer several questions concerning the way these systems will react under real and often different conditions.

The answers to these questions came from the conquests of the human intellect, as described below.

1. The first and probably most important step in this direction is the understanding of nature's laws, as well as the knowledge that they are perfectly dependable. This is called science.
2. Another important step is that we have learned as intelligent beings how to use the laws of nature to build our own systems in order to perform various tasks. This is called engineering.
3. The third step, which is directly related to the previous one, is that we have learned to predict the dynamic behavior of systems that have not yet been built. This is called dynamic analysis. This step is very important due to the fact that it is the key to investigating the proper function of the proposed systems under different conditions and environments. With this in mind, the dynamic behavior of large, complex systems is found to be made up of elementary behavior patterns, which can be discerned and studied one by one. The process of discernment can be accomplished by a repeated application of relatively elementary analytical techniques.

Therefore, from the design of a circuit in order to perform a specific task to the design of even more complex systems, such as a space vehicle for the exploration of the planet Mars, a procedure of dynamic investigation is the central point that threads together a number of the used physical systems at their inception. According to this procedure, the script, from which the specifications are drawn up, is written; the preliminary designs are developed; "breadboard" models are "made"; early tests are designed, executed, and analyzed; and final design decisions are made. This is the protocol against which the final performance of each subunit will be measured, first alone and then in concert with its teammates.

More specifically, the main aim of a dynamic investigation is to understand and predict the dynamic behavior of a given system and sometimes to improve it. The detailed work in the dynamic investigation process depends on the physical media involved, the size and complexity of the system, the stringency with which it must perform, etc.

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Citation: Volos, C. Editorial for the Launching of Dynamics. *Dynamics* **2021**, *1*, 18–21. https://doi.org/10.3390/dynamics1010003

Received: 21 April 2021
Accepted: 29 April 2021
Published: 1 May 2021

However, regardless of the specific physical or chemical process being studied, the procedure for analytical investigation usually involves each of the following four steps [1].

1. The specifications of the system to be studied and the visualization of a simple physical model, in which behavior will match sufficiently close to the behavior of the real system, are considered.
2. The design of a mathematical model that represents the physical model, which involves the writing of the differential equations of motion of the physical model.
3. The study of the dynamic behavior of the mathematical model by solving the differential equations of motion. With the term motion, the change of any physical variable, such as velocity, voltage or current, temperature, etc., is meant.
4. The writing of design decisions, such as the choice of the physical parameters of the system in order for it to behave as desired, is the last step of this procedure.

In Figure 1, the four stages of the dynamic investigation procedure are depicted. From this scheme it is clear that errors in the analysis could be detected by the comparison of the behavior of the real system with the predicted dynamic behavior of the physical model. Therefore, some corrections to the physical model could be made in order to be more realistic. Furthermore, the application of design specifications to the real system could be done by using a feedback process.

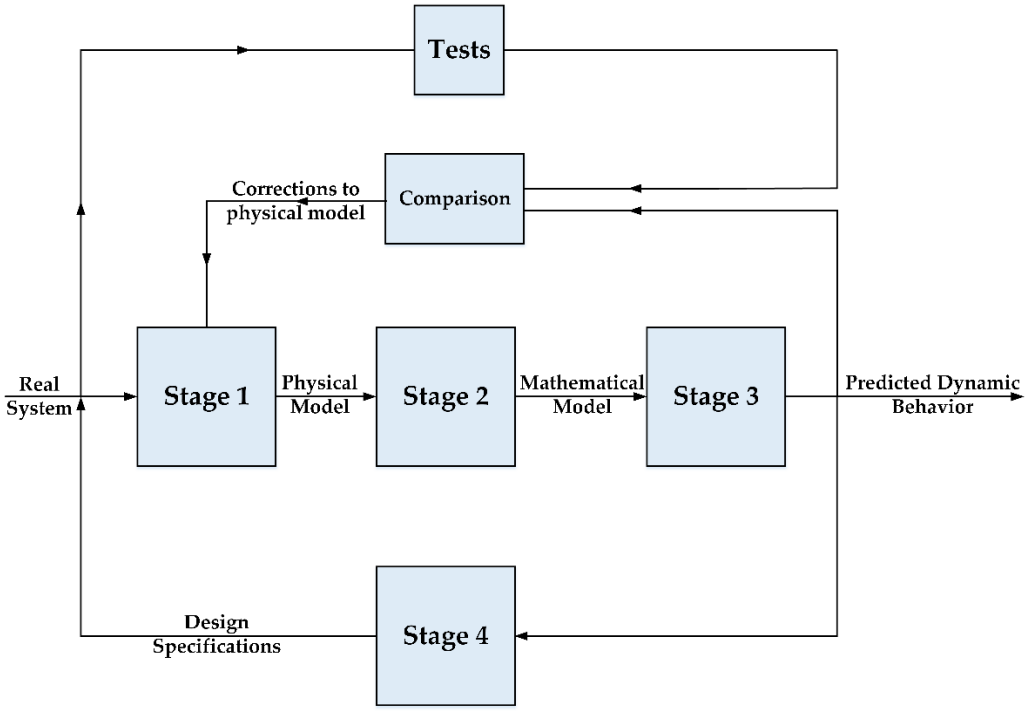

Figure 1. Schematic of the four stages of a dynamic investigation.

Therefore, the procedure of studying the dynamics of various systems has become more and more prevalent. This has happened because nowadays, due to the increased demand of using mathematical models to describe and predict the actual physical and chemical processes in modern industry, the scientific contribution related to the study of the dynamics of these kinds of processes has significantly increased. Especially in the last two decades, this scientific contribution has resulted in a great number of research papers published in various scientific journals. However, it is also important to notice that the dynamics of physical and chemical processes are not well represented in any editions. To the best of the Editor in Chief's knowledge, there is no well-established journal that covers this subject as a whole. For this reason, *Dynamics*, as a new journal, could fill an important

gap with scientific contributions in the field of dynamics of physical and chemical processes, covering all the spectrum of procedures that this field includes.

In more detail, the journal of *Dynamics* aims to cover the research needs of scholars who work mainly in physical and chemical processes. Therefore, it will be focused on the study of systems from these two main basic fields by presenting not only theoretical but also experimental results. Papers related to the study of physical processes regarding aerodynamics, biodynamics, celestial dynamics, climate dynamics, fluid dynamics, electronic and structural dynamics, gas dynamics, hydrodynamics, relativistic dynamics, and thermodynamics are some of the works that are welcome in the journal of *Dynamics*. Additionally, research works related to chemical processes, such as the study of chemical reactions dynamics, the dynamics of atomic and molecular systems, and also the study of how energy is transferred among molecules as they undergo collisions in gas-phase or condensed-phase environments, will be considered for publication.

Furthermore, papers that will be focused on new results concerning the theory of the dynamics of differential equations (ordinary differential equations, stochastic differential equations, fractional order systems, nonlinear systems, and chaos) and their discrete analogs, which consist of the mathematical base of the presented physical and chemical models, are also welcome. The journal will also publish papers dealing with computational results and applications of physical and chemical processes in biology, engineering, robotics, and the other sciences as well as papers in other areas of mathematics that have direct bearing on the dynamics of these kinds of processes.

In conclusion, contributions from all subjects related to the dynamics of physical and chemical processes will be accepted as original papers, technical notes, discussions, and responses in the regular issues. Additionally, researchers and research teams from these fields are encouraged to submit proposals for special issues on selected research areas related to important dynamics topics.

Topics in alphabetical order that the journal of *Dynamics* covers are presented below.

- Aerodynamics
- Analytical dynamics
- Biological physics and networks
- Brownian dynamics
- Chaos, nonlinear dynamics, and applications
- Chemical reactions dynamics
- Celestial mechanics
- Climate dynamics
- Complex systems and complexity
- Dynamics of atomic and molecular systems
- Electronic and structural dynamics
- Fluid dynamics
- File dynamics
- Fractional dynamics and applications
- Gas dynamics
- Magnetohydrodynamics, turbulence, and plasmas
- Langevin dynamics
- Laser optics
- Multi-scale/multi-physics dynamics
- Nonholonomic mechanics
- Quantum mechanics and electrodynamics
- Relativistic dynamics
- Stability, control, and synchronization
- Soil dynamics
- Thermodynamics
- Vortex dynamics

With all the editorial board members, MDPI support, carefully selected reviewers, and researchers who work in this field from all around the world, we wish a great success to our journal *Dynamics*.

Conflicts of Interest: The author declares no conflict of interest.

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Short Biography of Author

Christos Volos obtained a Ph.D. in the field of "Nonlinear Circuits" in 2008 from the Physics Department, of the Aristotle University of Thessaloniki (Greece). In 2010, he joined the Laboratory of Electronics and Telecommunications of the Greek Army Academy. Four years later, he joined, as a lecturer, the Physics Department of the Aristotle University of Thessaloniki. He currently serves as an Associate Professor in the same department. Additionally, since 2016 he has been a member of the Laboratory of Nonlinear Systems, Circuits & Complexity (LaNSCom) and he has worked on a large number of Greek or European funded research projects dealing with nonlinear systems and their applications. His research interests include, among others, the study of nonlinear chaotic systems, the design of analog and mixed-signal electronic circuits, chaotic electronics and their applications (secure communications, cryptography, robotics), experimental chaotic synchronization, chaotic UWB communications, as well as measurement and instrumentation systems. Dr. Volos has authored or co-authored of more than 280 papers published in journals, book chapters, and proceedings in international and national conferences. He is also a co-author of one book, editor or co-editor of nine other books, member of the editorial board of seven scientific journals related to systems, as well as he has served as a guest editor in more than 20 special issues of international scientific journals.