

THE APPLICATION OF MATLAB FOR THE GENERATION OF EFFECTIVE VALUES IN THE TECHNOLOGICAL MANAGEMENT PROCESS

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Abstract

The generation of characteristic values for the stability of the control system is the main focus of this paper. For the generation of these values, a system for evaluating the state of the parameters of the control system must be incorporated, in the context of the work of certain devices in the control system based on the management of the computer system. The focus of the analysis of system parameters, simulation and parameter change is based on the use of the Matlab application. The purpose of this paper is to incorporate applications that can be included in the management process, obtaining results, and adequately reflecting the obtained values, graphs and finding the corresponding concrete structure to see the flow of a process as closely as possible. The goal of the paper is the computer system management through the application, specifically the use of Matlab. The paper will also deal with the collection and systematization of data in a database- application, which is connected to applications such as Matlab, to save and to create connections with other platforms in the framework of production and service; such is the internet platform and the deployment of a web browser that gives a more generalized direction in terms of use, service and management of resources at different distances - locations that have direct access through web technologies or other computer network resources. Through the Matlab application, the state of the system can be analyzed by changing the program parameters, which creates a certain view of the state, looking at the view of the graphs-curves, of the device until its activation. Therefore, all this includes the way of integrated management of some systems and applications to create a more optimized effectiveness of the technological process.

Keywords: Technology, Matlab, Applications, Web browser, Computer system.

1 Introduction

This paper deals with the aspect of the software approach and the research in a technological process. The use of relevant applications enables the creation of sustainable technological structures. Technological processes need continuous management; therefore, the design of a sustainable one creates the possibility of better maintenance in the future. Therefore, in the paper, a block scheme has been created, and certain circuits mediate an important functionality of the system through the management of a database, where data collection is done.

In the paper, there is a good opportunity to use an application such as Matlab, from which programs specifically intended for the analysis of technological processes can be made, and in the extraction of relevant parameters, in terms of work with effective values. This type of design consists of the functionality of the process in general, but also the increase in performance and the level of optimization of the operation of the parameters that take part in the process itself, to create stable work [1][2].

2 The use of Matlab in technology and simulating the state of the system

Today, automatic control systems, i.e. automatic regulation systems, are inevitable in everyday life. To determine whether they meet the requirements in terms of stability, speed of response to changes in input size, degree of sensitivity to disturbances, etc., it is necessary to know the dynamics of these systems. The dynamics of the system are described by differential equations. The problem arises when these differential equations are too complex to solve analytically. Then it is useful to replace the system with an analog model. Measurements are made on the model, which are translated into the conditions of the tested system. Usually, it is very easy to implement changes in the system parameters on the model, and the influence of these parameters on changes in physical variables is quickly assessed [3][4].

Automation is a technical-economic discipline made up of all technical organizations and economic disciplines interconnected to achieve the best possible production. Modeling is a process of the human mind and is regularly a simplified representation of the observed reality [4]. Modeling made it easier to solve the system, problems related to its creation, and its operation. The goal of modeling is to approximate the observed system as much as possible in the simplest possible way while keeping all relevant characteristics of it. Modeling makes it easier to create and spot potential problems, failures, and malfunctions, as well as improvements

The model can be mathematical or described graphically, such as a block diagram. From the model, computer code can be created that imitates the results provided by the system. There are six steps in modeling any system:

- defining the system or simulation goal,
- identifying the system components,
- modeling the system with equations,
- creating a block diagram in simulation program,
- running the simulation and
- confirming the simulation results.

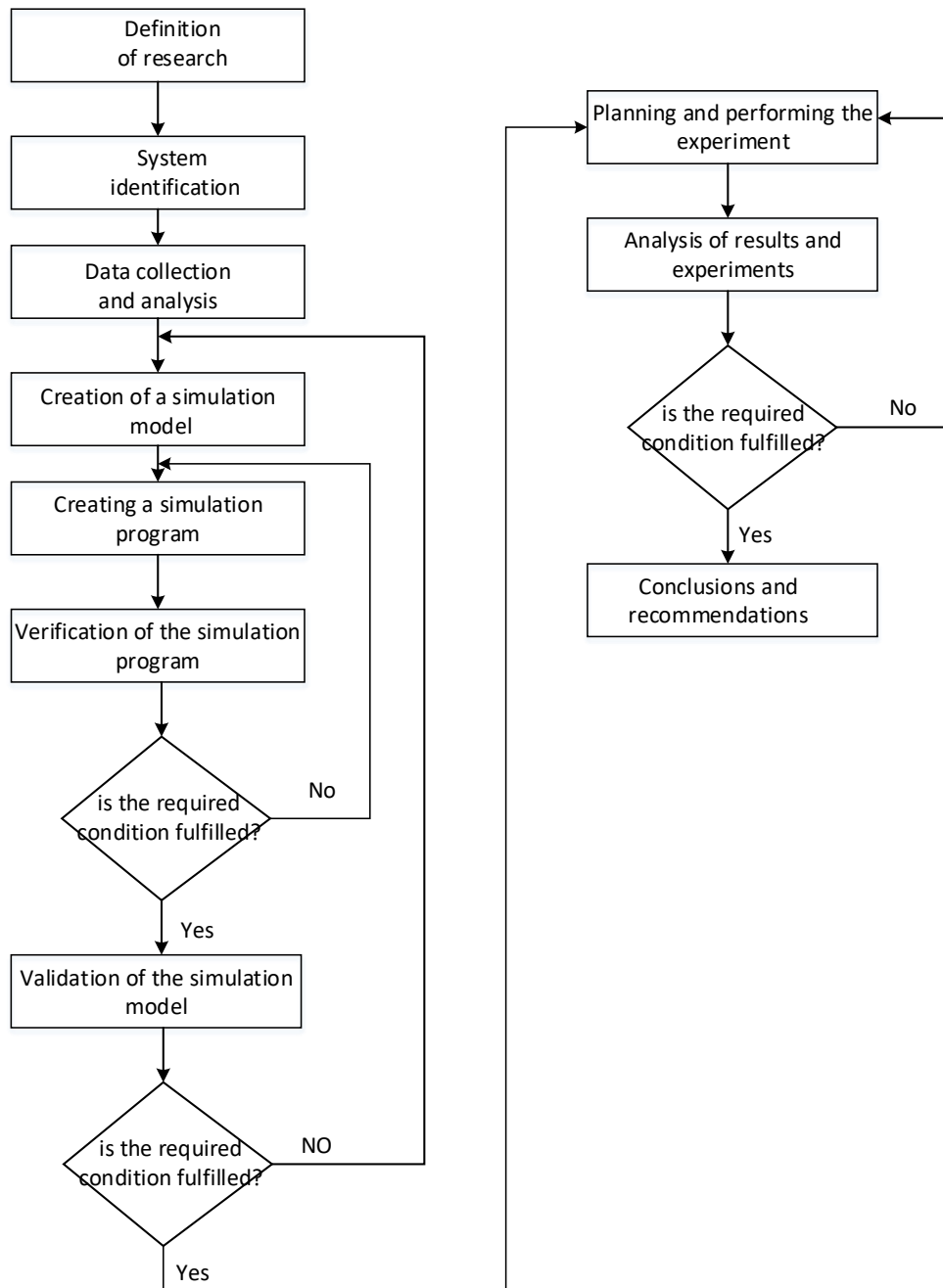


Figure 1- Flow diagram of the simulation process

The block for planning a simulation experiment and its execution from Figure 1, indicates the planning of simulation experiments that enable the fulfillment of the simulation goal. A different division of the simulation process is found in the literature. The simulation procedure can be divided into three phases, namely: 1. Model translation, 2. Model connection and 3. Simulation. Model translation In this phase, the model is translated into an executable form, during which the following operations are performed: block parameters are calculated, and signal properties are determined. An optimization procedure is carried out to reduce the number of blocks in the scheme: virtual blocks are replaced by the blocks they contain; a list of blocks is formed, which is used in the model connection phase as a starting point for determining the order of block execution. Times are determined sampling blocks for which the sampling time is not explicitly specified [1] [2]. Furthermore, based on the list of blocks created in the previous phase, the most efficient order of block execution is determined so that algebraic loops do not occur. It also considers the possible level of priority that the user can assign to an individual block. Simulation this phase successively calculates the states and outputs of the system at moments in time that may or may not be at uniform

intervals, which depends on the selected differential equation solver. Modern modeling is practically unimaginable without computers or computer programs, which are used in modeling primarily for two purposes: - model development and - budgeting. The term "modeling and simulation" denotes a complex activity that includes three elements: a real system, a model, and a computer. Finally, it should be seen why Matlab was chosen for simulation and modeling. Some advantages of Matlab compared to "classical" programming languages like Fortran or C are: the interactive interface enables fast experimentation (Matlab is an interpreted language unlike, for example, Fortran, which is translated - compiled), minimal care about data structures (there are practically no declarations of variables and fields unless you want to define something exactly in a special way), Matlab enables fast and easy programming (thanks to the powerful matrix concept), the built-in graphics subsystem enables simple, high-quality and quick visualization, programs written in the Matlab language (so-called m-files) are ordinary text files and are therefore completely portable between different operating systems/platforms, there are numerous additional packages, i.e. groups m-files for various special areas and there are numerous m-files and entire packages that authors, as well as users, make freely available via the Internet [5][6].

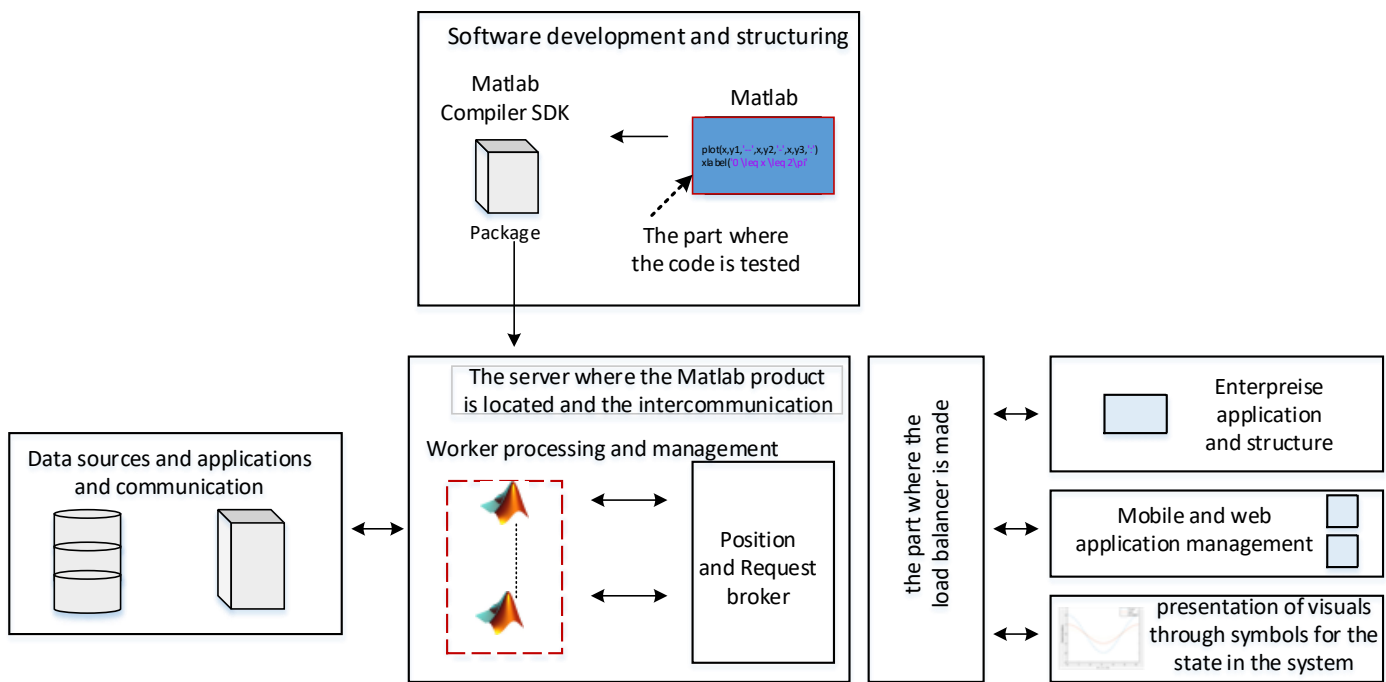


Figure 2- The model of scaling, security and system management

During communication through the computer network, of course with special emphasis on computer systems, as an important communication is serial communication [7][8].

In the following block diagram, in Figure 3, serial communication is presented, the computer as a command unit, the Arduino microcontroller as a control medium, etc. Also in the block scheme, Matlab is seen as a sustainable resource, from which relevant schemes can be created for command issues, for the generation of effective values that help in the process of industrial management [8][9].

Almost in every command system, there are also time relays, which enable switching on and off of different contactors. Therefore, the time relays precede the command to access the electrical, hydraulic, and pneumatic systems, which through the servo systems can realize a relevant approach, by changing the parameters of the system itself.

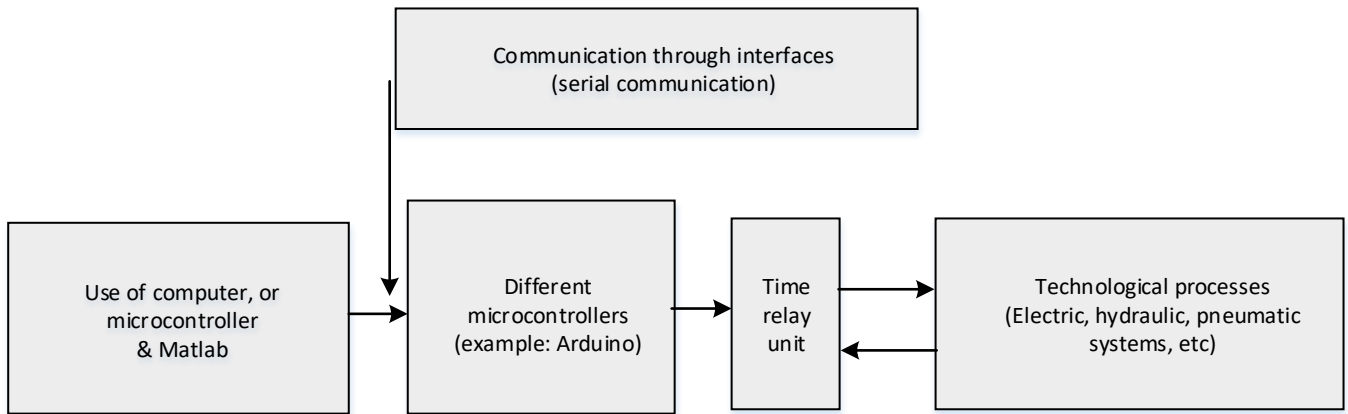


Figure 3- The technological process, the use of the computer, microcontroller and Matlab as an application in the structuring of the state of the process

3 Analysis of the simulation in increasing the performance of the system through examples

The importance of using Matlab is very great, because with this it is possible to generate the values of the parameters through the simulation system and to generate the corresponding graphs, which will follow all the work of the process in the corresponding technology, and changes can be made in case the system must be changed, due to technological requirements or due to certain defects that may occur in the system itself [1] [2][3].

Example1: With Matlab code, the Generating some arbitrary effective numbers through code in Matlab:

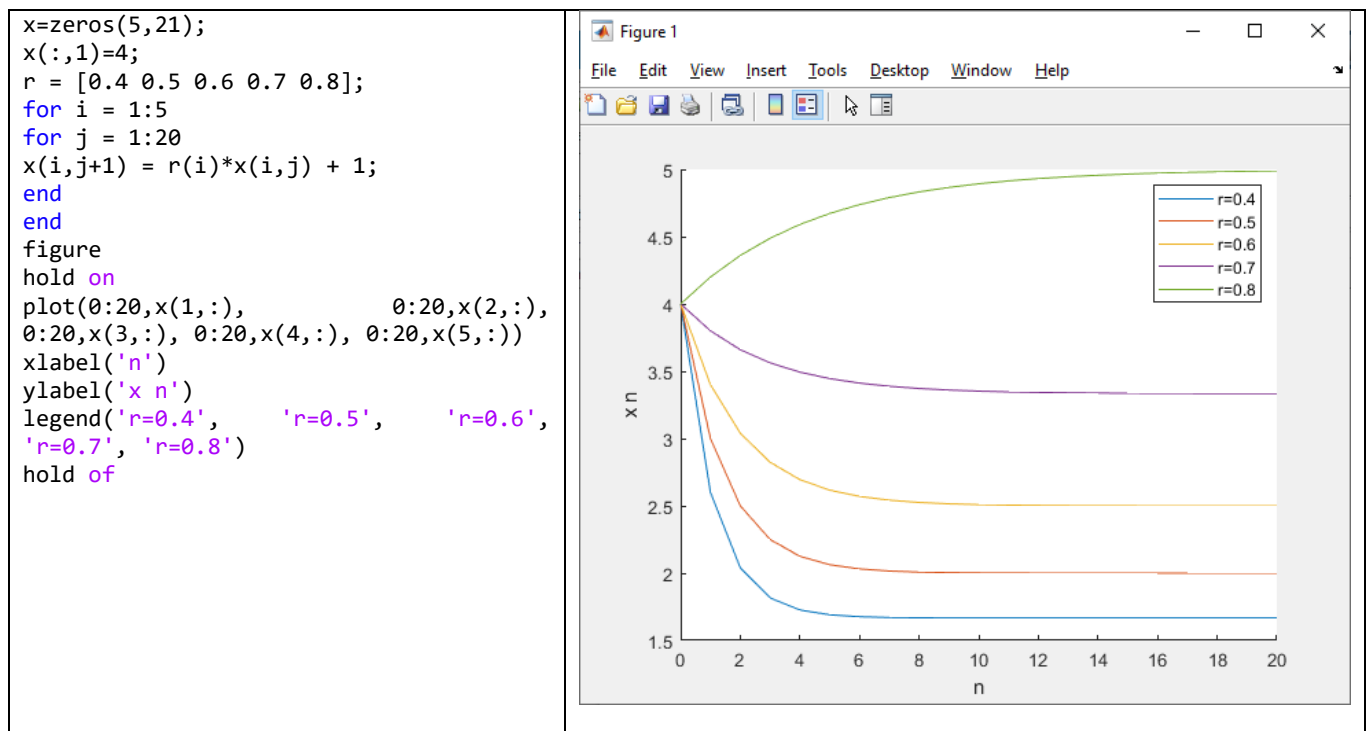


Figure 4- The Generating some arbitrary effective numbers through code in Matlab

Example 2: The generation of certain values by the system model, the determination of angular displacements, depending on the context of the use of a technological device. Accordingly, this situation is also like a preliminary analysis of any displacement of any parameter, in the framework of an electronic simulation scheme.

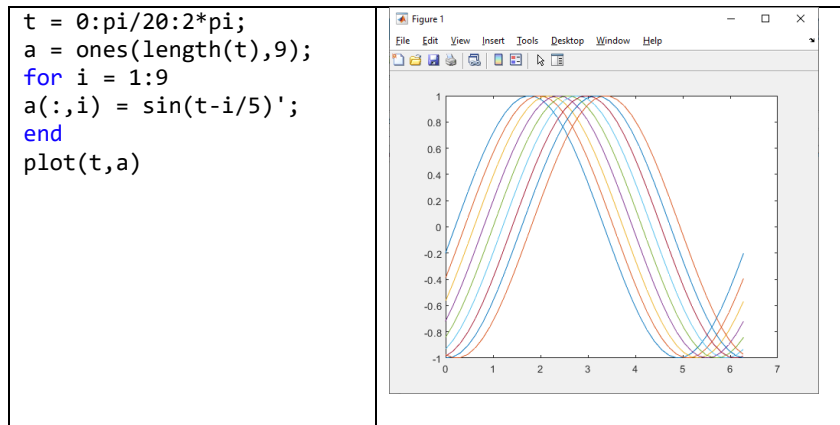
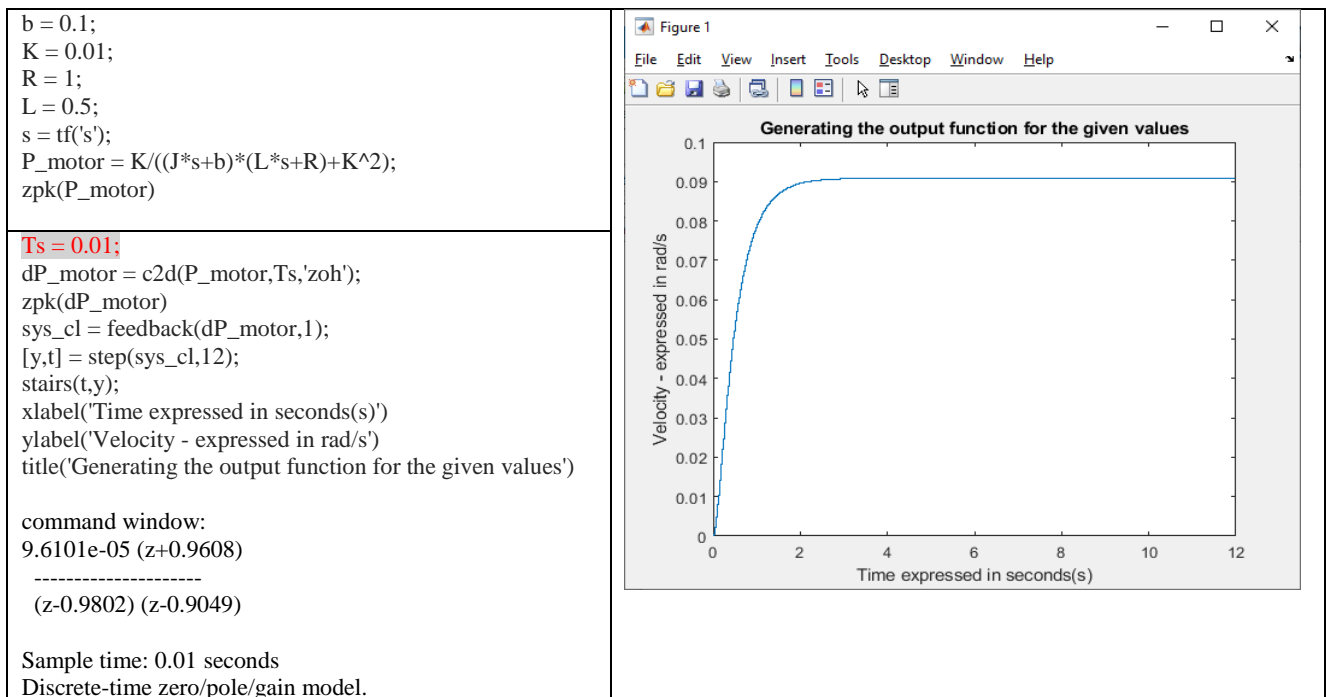


Figure 5- The generation of certain values in accordance with the system model, the determination of angular displacements

Example3: In the following example, it is given as an example of the Matlab code, through certain discrete values (M.Kalechman, 2018). In this case, we will convert the given transfer function from the continuous Laplace domain to the discrete z-domain. Matlab can be used to achieve this conversion through the use of the `c2d` command. The `c2d` command requires three arguments: a system model, the sampling time (T_s), and the type of hold circuit. In this example, we will assume a zero-order hold (zoh) circuit) [1][3][7].



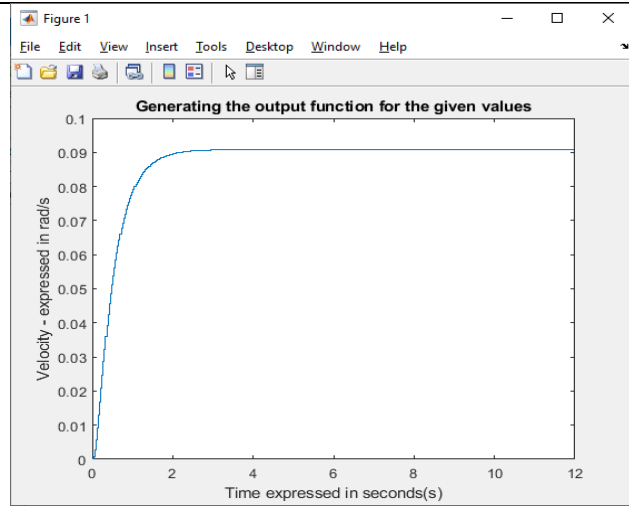
(a)

Ts = 0.03;
(then: the same code from figure (a) is repeated)

command window:
0.00079989 (z+0.887)

(z-0.9417) (z-0.7409)

Sample time: 0.03 seconds
Discrete-time zero/pole/gain model.



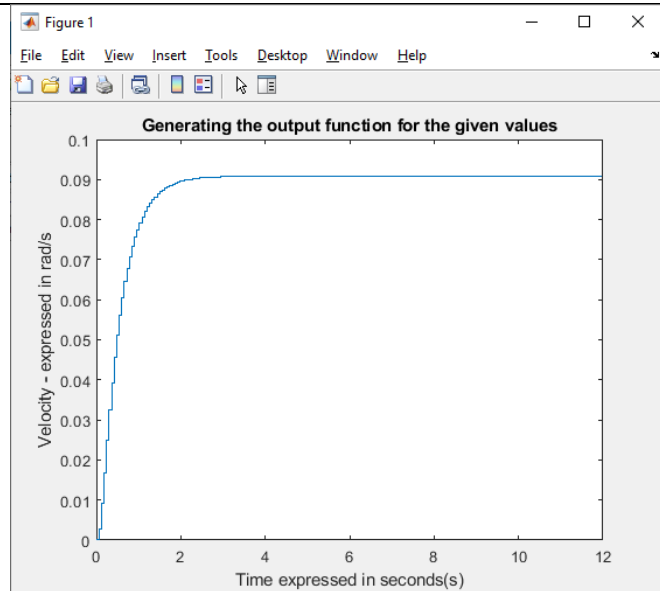
(b)

Ts = 0.06;
(then: the same code from figure (a) is repeated)

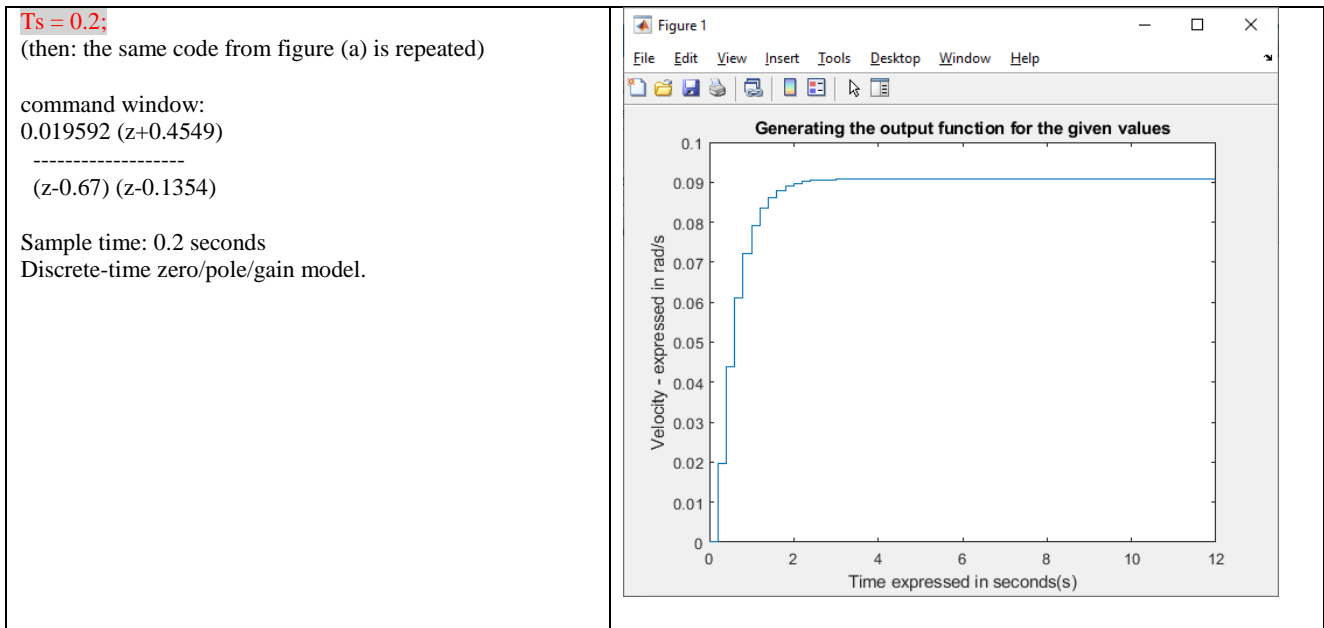
command window:
0.0028552 (z+0.7869)

(z-0.8868) (z-0.5489)

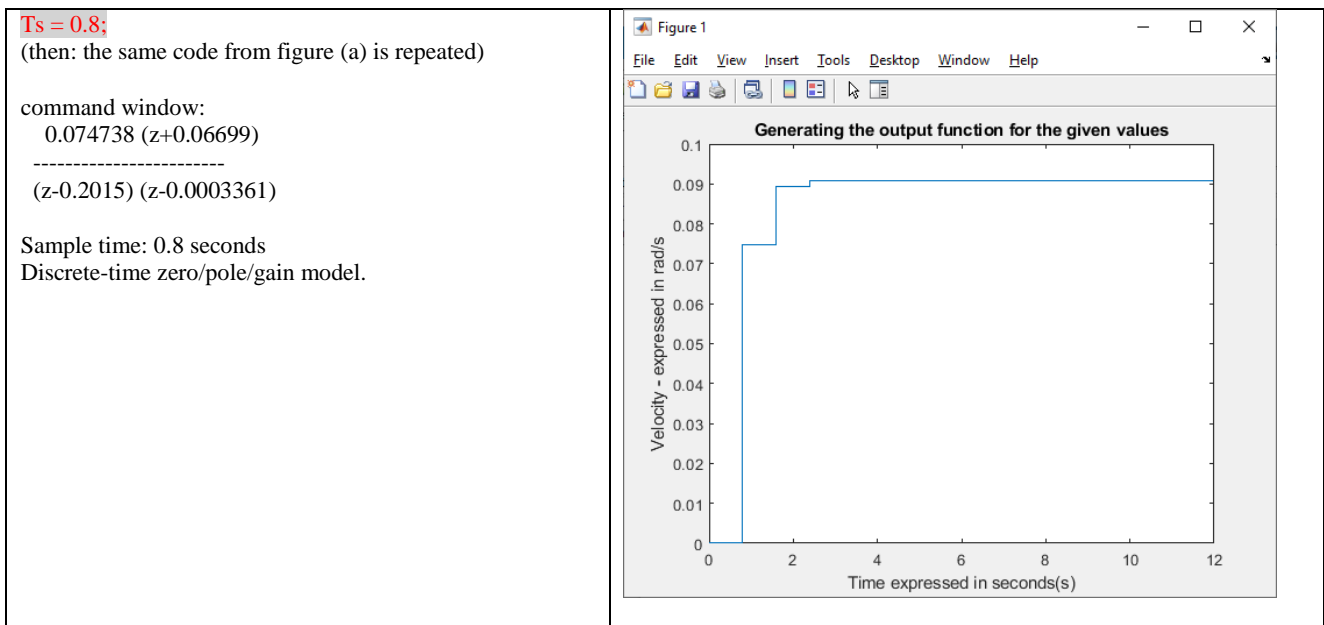
Sample time: 0.06 seconds
Discrete-time zero/pole/gain model.



(c)



(d)



(e)

Figure 6- (a), (b), (c), (d), (e)-Several models, with time-varying T , Discrete-time zero/pole/gain model.

If the time delay of activation in the work of the device (specifically the work of the engine, generator, or tachogenerator, etc.), then from Figure 6 can be seen, that the continuity of the gradual increase in the work of the device is lost and the degree of jumps from one point to another increase [8][9]. Therefore, the shorter the activation time, the more continuous and smooth the function is during the activation process. Specifically, this example does not deal with the issue of speed stabilization, until the normalization of the device's work. But the example deals with the aspect of increasing the speed, in the form of a smooth increase, without jumps, and without the progression of the steps which would affect the interruption of the fish process of the discrepancies in the movement.

Conclusion

The paper describes the respective algorithm (Figure 1- Flow diagram of the simulation process), the technological process, and the use of the computer, microcontroller, and Matlab as an application in the structuring of the state of the process (Figure 2). Generating some arbitrary effective numbers through code in Matlab and generation of the values of certain parameters (Figure 3), and - several models, with time-varying T, Discrete-time zero/pole/gain model (figure 6). To change the constant values, must consider the conversion domains. However, this is another field of research, but here it is emphasized that due to the ease of system management, systems that convert data should be built. Therefore, it is very important to analyze the state of the system in the continuous domain and then convert the values in the discrete "z" domain through the Matlab program. In terms of value management, it is considered that the state and characteristic parameters of the system fulfill the condition of system stability. Then, they also fulfill the condition and criterion of stability based on the criteria for determining the stability of the system (and this part has not been the focus of our work, because it was previously underlined that we must first have such a system, and this type of assessment is realized in other conditions), the activity has been determining the possibility of generating output values (response-speed) based on input values, for the given time, etc. Also, in the paper presented, the technological process, the use of the computer, microcontroller, and Matlab as an application in the structuring of the state of the process and the model of the intercommunication of the devices, describing the flow of data movement.

Also, in the paper, it is presented and highlighted, during the process of communication through the computer network, with special emphasis on computer systems, as an important communication is serial communication. This communication would be reasonable if the serial communication port is used by the computer as a command unit. In this case, for an industry of considerable size, a system like Arduino microcontroller as a control medium can also be used. In the first scheme, the model of scaling, security, and system management is presented, which represents a relevant approach with several combined systems: industrial system, Matlab, data flow, collection, and management of data from a system with a database together.

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