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Providing transfer function for the population model

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ABSTRACT

Objective: Solve complex social and humanitarian issues has long been dream of scientists and researchers. And the most important tool for there issues is simulation. **Methodology:** we tried combine several different simulation methods for population transfer function. Note that the transfer function in the field of humanities is considered as low. Hence another reason for us to offer combine different simulation methods. **Results:** in first step, we provide a population model based on the stock-flow diagram (system dynamic) and then, transfer this model to block diagram model in Matlab. Finally, we calculation transfer function and compared the step response of three methods. We hope that the hybrid approach, be considers in the field of humanities. **Conclusion:** Although the relations in the humanities sciences is complex but, using the transfer function can be Step forward. Finally we can expand this hybrid approach to the other examples and present more transfer function in the humanities sciences. So that we can solve more social problem.

1. Introduction

Find tools that have ability to solve community problems is important. In this context, simulation is considered. Simulation of human sciences, is based on the stock-flow diagram and the transfer function is not used. In this study aims to provide a new way to simulation, we combine of three methods. The three methods are: stock-flow diagram (humanities sciences, engineering sciences), block diagram model (engineering sciences, humanities sciences), transfer function (engineering sciences) (Afshar Kazemi and Abolfathi, 2014).

System dynamic: is an approach to understanding the nonlinear behavior of complex systems over time using stocks, flows, internal feedback loops and time delay also is a methodology and mathematical modeling technique to frame, understand, and discuss complex issues and problem sd is currently being used throughout the public and private sector for policy analysis and design (Sterman, 2000).
Block diagram model: a diagram showing in schematic form the general arrangement of parts or components of a complex system or process, such as an industrial apparatus, also is a diagram of system in which the principal or functions are represented by blocks connected by lines that show the relationship of the blocks. They are heavily used in engineering in process flow diagram (Liu, 2014).
Transfer function: a mathematical function the output or response of a system, also known as the system function is a mathematical representation for fit or describe input and outputs of black box model (Zhang, 2014).

1.1 Literature Review:

Reddy and Srinivas, (2016) presented in an article entitled, dynamics in harvested prey-predator mathematical with noise and diffusion. They consider a two dimensional nonlinear pray-predator model with harvesting on both the species and specifically with mortality rate of the predator species. The purpose of this work is to offer mathematical analysis of the model and discuss some of the vibrant qualitative results that expected to arise from the inter-play of the biological internal and external force. Also they studied the analytical estimates for population intensities of fluctuations by fourier transform methods through stochastic perturbations. They have also highlighted the diffusive stability of the system along some numerical simulation.

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Qianhong et al., (2015) presented in an article entitled, Dynamical behaviour of second-order rational fuzzy difference equation. They concerned with the existence, the boundedness and the asymptotic behavior of the positive solutions of a second-order fuzzy nonlinear difference equations. The parameter and initial values of system are positive fuzzy numbers. Finally an example is given to illustrate the effectiveness of the results obtained.

Shankar Khanday et al., (2015) Have stated in an article entitled, Analysis of static and dynamic loads on chimney foundation in modular design of cold rolling mill, Analysis of static and dynamic loads on equipment foundation in modular design of cold rolling mill has biggest challenges that any design engineer could face during rolling mill design. If not properly analyzed, it could lead to a large amount of destruction in terms of performance of the cold rolling mill, property, loss of life and money. A prescriptive approach to mechanical design in the form of various codes and standards, has been utilized which helps to solve the problem to a greater extent by regulating strict norms for design, material and construction of the equipment's. In this paper mechanical calculation is investigated by referring ASCE-7-98 Chapter 6.2, IS: 6533 (part II) and Design Data PSG Tech. for material properties, modelling by means of mechanical CAD software (Auto CAD and Solid works) and the analysis has been made by means of the FEM software of Solid works.

Gu and Xia, (2012) Have stated in an article entitled Global analysis of a plant-hare dynamic with stage structures, A plant-hare model with stage structure for plant is proposed in this paper. By analysing the corresponding characteristic equations, the local stability of the equilibria is investigated and Hopf bifurcations occurring at the positive equilibrium under some conditions are demonstrated. Taking time delay as bifurcating parameter, the direction and stability of Hopf bifurcation are carried out.

Fernandez et al., (2005) Have stated in an article entitled, Stimulation of cannabinoid receptor suppresses microglial activation. Activated microglial cells have been implicated in a number of neurodegenerative disorders, including Alzheimer's disease, multiple sclerosis, and HIV dementia. It is well known that inflammatory mediators such as nitric oxide, cytokines, and chemokines play an important role in microglial cell-associated neuron cell damage. Our previous studies have shown that CD frothy signaling is involved in pathological activation of microglial cells. Many data reveal that cannabinoids mediate suppression of inflammation in vitro and in vivo through stimulation of cannabinoid receptor two they investigated the effects of a cannabinoid agonist on CD40 expression and function by cultured microglial cells activated by IFN-γ using RT-PCR, Western immunoblotting, flow cytometry, and anti-CB small interfering RNA analyses.

Glazebrook and Baianu (2010) Have stated in an article entitled, Categorial Ontology of Complex Systems, Meta-Systems and Levels: The Emergence of Life, Human Consciousness and Society, Relational structures of organisms and the human mind are naturally represented in terms of novel variable topology concepts, non-Abelian categories and Higher Dimensional Algebra. A unifying theme of local-to-global approaches to organismic development, evolution and human consciousness leads to novel patterns of relations that emerge in super- and ultra- complex systems in terms of compositions of local procedures. The claim is defended in this paper that human consciousness is unique and should be viewed as an ultra-complex, global process of processes, at a meta-level not sub.

Jameson and Vinay (2008) presented in an article entitled, Absence of stimulus-driven synchronization effects on sensory perception in autism: Evidence for local under connectivity?, they hypothesized that if the larger-scale aberrant dynamics in autism were due – at least in part – to a widespread propagation of the errors introduced at the level of local connectivity between mini columns, then aberrations in local functional connectivity should also be detectable in autism. Methods Recently, we reported a method for measuring the perceptual changes that are impacted by the presence of synchronized conditioning stimuli on the skin. In this study, the temporal order judgment and temporal discriminative threshold of ten adult autism subjects were assessed both in the absence and presence of synchronized conditioning vibrotactile stimuli.

Bizzarro and Fontanella (2012) presented in an article entitled, Annexin N-terminal derived peptide ac stimulates fibroblast migration in high glucose conditions, they observed the enrichment of Annexin A-one protein at cell movement structures like lamellipodial extrusions and interestingly, a significant decrease in levels of the protein in HG conditions. The analysis of the translocation of Annexin A-one to cell membrane showed lower levels of Annexin A-one in both membrane pool and supernatants of WS-one cells treated with HG. Wound-healing assays using cell line transfected with Annexin A1 siRNAs indicated a slowing down in migration speed of cells suggesting that Annexin A-one has a role in the migration of WS-one cells.

2. Materials and methods

2.1 Methods:

In first step, we present the population model based on the stock-flow diagram, in figure (1) population is output, birth and death is flow (percent of population), migration is input (step function, the range of 1 and the start time of 0), birth rate is 0.02 and death rate is 0.003 (based on experience), math formula for population is integral (birth – death + migration, the initial value of the integral is zero), migration input can be impulse and ramp, …. Also we used vensim software.

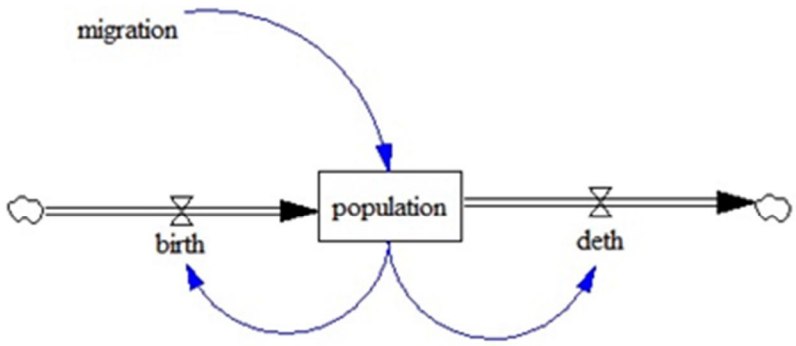

Figure 1. population stock-flow diagram

In second step, we turned population stock-flow diagram to population block diagram model. Values are identical to the previous model and we used Simulink matlab software.

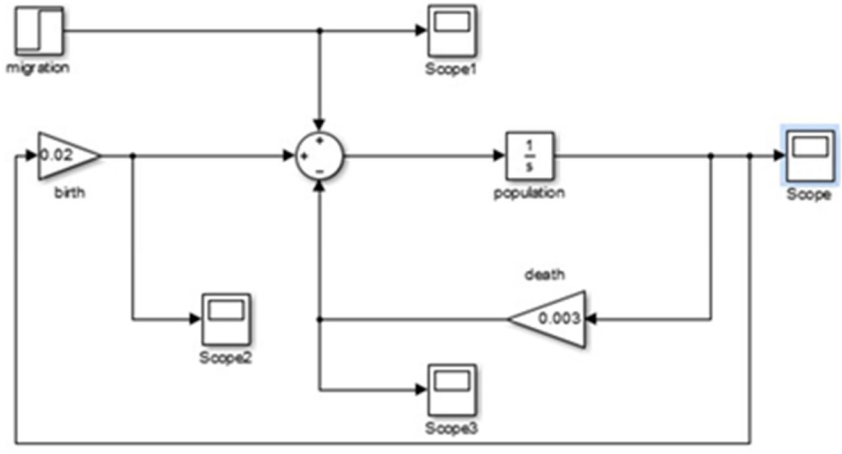

Figure 2. Population block diagram model

In third step, we will calculate the transfer function where the input (migration) is x and the output (population) is y. how is calculated as follows:

$$y(t)= \int x(t) + 0.02 * y(t) - 0.003 * y(t) \quad (1)$$

$$y(t)= \int x(t) + \int 0.02 * y(t) - \int 0.003 * y(t) \quad (2)$$

$$y(s)= \frac{x(s)}{s} + \frac{0.02*y(s)}{s} + \frac{0.003*y(s)}{s} \quad (3)$$

$$y(s)= \frac{x(s)}{s} + \frac{0.017*y(s)}{s} \quad (4)$$

$$y(s) - \frac{0.017*y(s)}{s} = \frac{x(s)}{s} \quad (5)$$

$$y(s) \left[1 - \frac{0.017}{s}\right] = \frac{x(s)}{s} \quad (6)$$

$$y(s)\left[\frac{s-0.017}{s}\right] = \frac{x(s)}{s} \quad (7)$$

$$G(s) = \frac{y(s)}{x(s)} = \frac{1}{s-0.017} \quad (8)$$

In fourth step, we will calculated the step response for the three methods. How is calculated the step response in the third method as follows (we used matlab software):

```
>> x = [1];
>> y = [1 -0.017];
>> sys = tf(x,y)
>> t = 0:1:100;
>> out = step(sys,t)
>> plot(t,out)
```

In fifth step, we compare the step response in three methods, why we want to insure the accuracy of the calculation of transfer function.

3. Discussion and results

3.1 Data and finding:

Figure (3) shows, step function (migration input) in three methods (the start time is zero and the range is one)

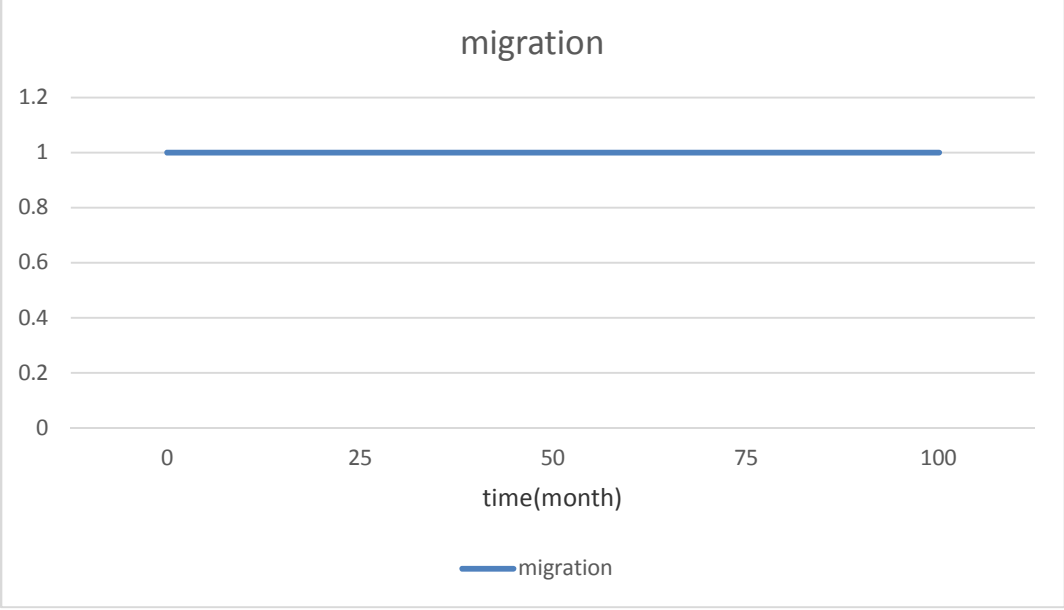

Figure 3. Step function (migration input)

The fourth figure shows the output (population) in the vensim software (system dynamic model)

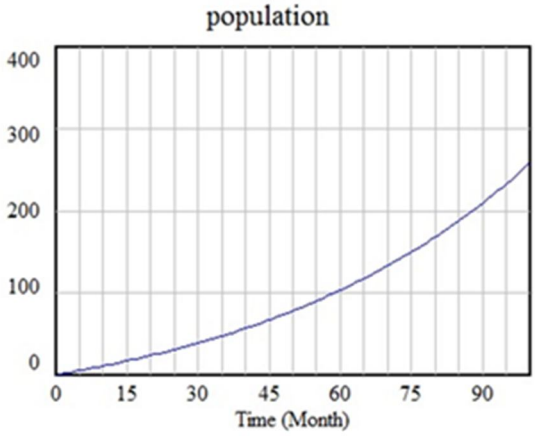

Figure 4. The vensim software output (population)

The fifth figure shows the output (population) in the Simulink matlab software (block diagram model)

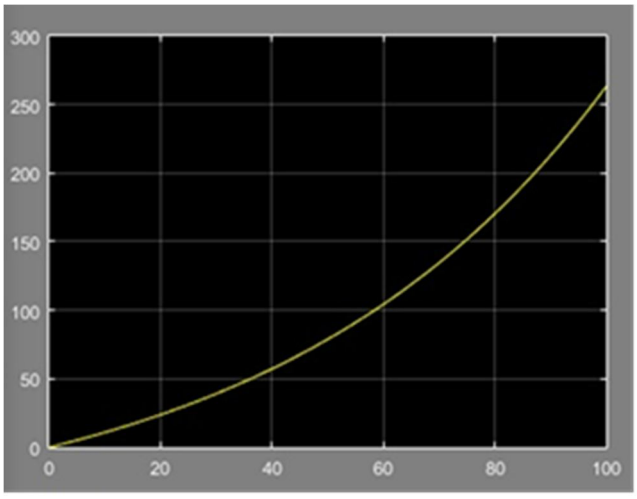

Figure 5. The Simulink matlab software output (population)

The sixth figure shows the output (population) in the calculated transfer function.

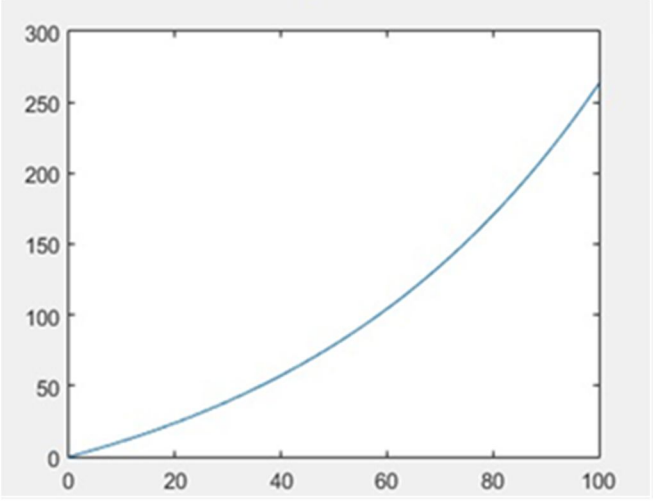

Figure 6. The calculated transfer function output (population)

The seventh figure shows, the transfer function is calculated correctly. (By comparing the three charts)

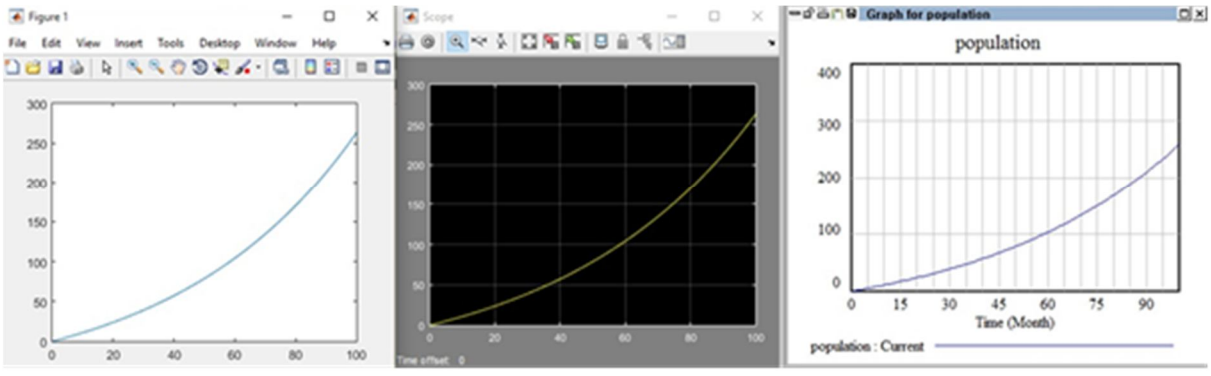

Figure 7. Compare three charts

In this study, the first simulation model (system dynamic model) presented on, all the system dynamic books and its output is valid and specified. So its output is already known. Note that the block diagram model and transfer function model calculated on the basis of the system dynamic model, so the block diagram model and transfer function model have calculated correctly if their output is the same with system dynamic model. In the event, the same of their output, the second and the third model valid as the first model. Also the previously showed that the structure of these three models is the same.

4. Conclusion

In figure 7, the three charts is the same, so the transfer function is accurate. Also population stock-flow diagram (system dynamic model) is very famous and prestigious and cause the transfer function based on the population stock-flow diagram so it's validate. We can offer a classification of transfer functions and it can be recognized the stubble transfer function. For this concept we use the family model. In this regard, we have already achieved all transfer function And be classified this transfer function. Then we need to verify that the transfer function is similar to one of the class. also, we present this study the transfer function that was previously in the engineering sciences to the humanities sciences, Although the relations in the humanities sciences is complex but, using the transfer function can be Step forward. Finally we can expand this hybrid approach to the other examples and present more transfer function in the humanities sciences. So that we can solve more social problem.

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