International Journal of Innovative Research in Computer Science & Technology (IJIRCST)
ISSN(online): 2347-5552, Volume-11, Issue-2, March 2023
https://doi.org/10.55524/ijircst.2023.11.2.3
Article ID IRP1360, Pages 16-18
www.ijircst.org

The Simple Model of Newton's II Law and Its Applications

Indri Dayana[1], Habib Satria[2], and Yudi[3]

[1,2]Engineering Faculty, Universitas Medan Area, Medan, Indonesia
[3]Computer Information System, Potensi Utama University, Medan, Indonesia

ABSTRACT - The research aims to determine The Simple model for Newton's II Law and its application. The sample of this study is 20 sample variation. Data analysis technique used is by regression analysis. From the results of the analysis it was found that Freghitung=4,28 and Freg-table =4,13 (Freg-count >Freg-table), so the conclusion of this study is that there is a very large the simple model of Newton's II law and its application.

KEYWORDS- Simple Model; Newton's II Law; Newton's II Law Application

I. INTRODUCTION

Basic physics is one of the courses in semester 1 for engineering students. Physics has an important role in other subjects and as a preparatory course in semester 1 for engineering students. Newton's Second Law is one of the materials in basic physics that is studied for semester 1 engineering students. Newton's Second Law, which is one of Newton's III laws, is important material to understand [1]. Newton's Second Law is included in dynamics material which is widely used in everyday life including those related to object motion, object mass, object velocity, object acceleration and time [2].

Sir Isaac Newton (1964-1772) in his work Philosophiæ Naturalis Principia Mathematica stated three laws about the motion of objects [3].

I. Every object will continue to be at rest or move at a constant speed along a straight path if it is not forced to change its state of motion by forces acting on it (Newton's First Law).

II. The resultant force acting on an object will result in a change in momentum. The change in momentum per unit time experienced by the object is directly proportional with the resultant force acting on it (Newton's Second Law).

III. If an object exerts a force (action) on another object, then the object subjected to the action will exert a force (reaction) on the first object which is the same magnitude but the direction is opposite to the force of action (Newton's III Law).

Computational physics is an integral part of the development of problems or physical phenomena and the ability to anticipate them using computer devices. Making simulations of these physical phenomena can be done with algorithms and computer programs. The application of computers in physics is seen in solving complex analytical problems and numerical tasks for interactive solutions. Therefore, computational physics offers a combination of three disciplines and sciences, namely physics, numerical analysis and computer programming [4].

When viewed from the academic staff, there are still many teaching staff who are still reluctant to use computers, while computers are the main tool for the development of computational physics. In fact, more broadly, computers can be used as a tool for typing, data processing, experimentation or simulation tools, etc., supported by computer software capabilities [5], so that in general it can be said that the existence of computer technology can help the development of science physics.

The scope of the discussion mostly focuses on kinematics issues. Newton's Second Law can be used to help solve motion problems in one and two dimensions. Limiting the problem to one-dimensional and two-dimensional motion is not the final solution to all computational physics problems. Therefore, further studies are needed about the various physical symptoms that exist [6-7].

Whereas in terms of solving mathematical models there are constraints, such as linear mechanical vibrations N degrees of freedom, nonlinear mechanical vibrations, constrained particle motion in 2 and 3 dimensions, many-particle systems, analysis of rigid bodies for inhomogeneous bodies and arbitrary shapes, and gravitational fields by non-homogeneous objects and arbitrary shapes [8]. So, air resistance cannot be simply ignored. As an example are natural events that cannot ignore air friction, such as paratroopers, sky divers, jumping squirrels, and other small creatures that have also proven this [9-10].

II. METHODS

Methods compare simple model and practice. This method was chosen because researchers cannot control independent variables through manipulation or experimental treatment because treatment already exists and has occurred before by other people who are not researchers [11].

The test technique used to test the hypothesis in this study is regression analysis. This regression analysis is used to predict how far the value of the dependent variable changes if the value of the independent variable is manipulated/changed or increased and decreased [12].

The sequence of the algorithm is arranged as follows:

Step 1. Determine the value for the interval h

Step 2. Determine the initial velocity $v0= 0$

Step 3. The while $t <= t$ max loop

Step 4. Calculate the acceleration with the equation $F = m.a$

Step 5. Print time t, acceleration a, and velocity v.

Step 6. Multiply h and a and add the speed to get the new value of speed.

Step 7. Increment the time with h.

Step 8. Return to the loop in step 4 until t >tmax

Step 9. Finish/Exit.

The general equation of simple linear regression is

Y = ax + b………………………………..(1)

Then calculate the value of F using the formula:

F=S2reg/S2sisa……………………………………………
……………(2)

F-count compared to F-table with dk quantifier = 1 and dk denominator = n-2 uses an error level of 5% with the criteria F-count > F-table [13]. Then determine the correlation coefficient between the two variables using the rough product moment correlation formula as follows:

$$r_{xy} = \frac{n\Sigma X_i Y_i - (\Sigma X_i)(\Sigma Y_i)}{\sqrt{\left(n\Sigma X_i^2 - (\Sigma X_i)^2\right)\left(n\Sigma Y_i^2 - (\Sigma Y_i)^2\right)}}$$

……………………………………………….(3)

By criteria; if the price of Freg>Ftable with a significant level of 5% then the data is significant [14].

III. RESULTS AND DISCUSSION

Tabel 1:.Data for Acceleration of fixed

No	Mess (kg)	Accelaration (ms^{-1})	F=m.a
1.	0,1	2	0,2
2.	0,2	4	0,8
3.	0,3	6	1,8
4.	0,4	8	3,2
5.	0,5	10	5,0
6.	0,6	12	6,0
7.	0,7	14	9,8
8.	0,8	16	12,8
9.	0.9	18	16,2
10.	1,0	20	20,0
Amount	0,55	9,8	7,58

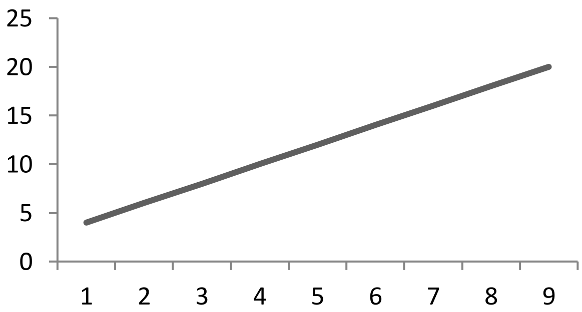

Figure 1: Data for Acceleration not fixed

For the acceleration of objects that are not fixed, the Newton force is obtained which is getting bigger and bigger depending on the mass of the object [15].

Tabel 2: Data for Acceleration fixed

No	Mess(kg)	Accelaration (ms^{-1})	F=m.a
1.	0,1	2	0,2
2.	0,2	2	0,4
3.	0,3	2	0,6
4.	0,4	2	0,8
5.	0,5	2	1,0
6.	0,6	2	1,2
7.	0,7	2	1,4
8.	0,8	2	1,6
9.	0.9	2	1,8
10.	1,0	2	2,0
Amount	0,55	2	2,9

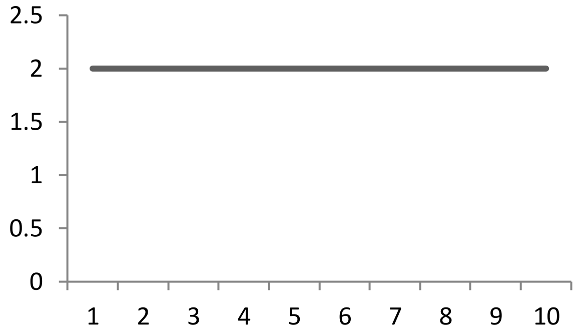

Figure 2: Data for Acceleration fixed

If the constant acceleration is taken as a sample of 2 ms^{-1}, the greater the Newtonian force, the longer it gets, depending on the mass of the object, which is also getting bigger.

this means that the Newtonian force and the mass of the object are directly proportional.

For large and varied data, this modeling program can help to understand and use it more easily. enough step-bye-step program that has been made [16].

IV. CONCLUSION

For the acceleration of objects that are not fixed, the Newton force is obtained which is getting bigger and bigger depending on the mass of the object [15] and for large and varied data, this modeling program can help to understand and use it more easily. enough step-bye-step program that has been made [16].

The Simple model for Newton’s II Law and its application. The sample of this study is 20 sample variation. The research method used was practice and compare modeling. Engineering students' abilities in learning physics can be helped with simple modeling. Data analysis technique used is by regression analysis. From the results of the analysis it was found that Freghitung=4,28 and Freg-table =4,13 (Freg-count >Freg-table), so the conclusion of this study is that there is a very large the simple model of Newton’s II law and its application.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

ACKNOWLEDGMENT

The authors would like to thank the for the facilities used in this research and the suppor to Universitas Medan Area Medan.

REFERENCES

[1] Bao, L., Hogg, K., & Zollman, D.(2002). Model analysis of fine structures of student models:An example with Newton's third law.American Journal of Physics,70(7),766–778. https://doi.org/10.1119/1.1484152

[2] DeCock, M.(2012). Representation use and strategy choice in physics problem solving. Physical Review Special Topics - Physics Education Research, 8(2),020117. https://doi.org/10.1103/PhysRevSTPER.8.020117

[3] Etkina, E.,Van Heuvelen, A., White-Brahmia, S., Brookes, D.T., Gentile, M., Murthy, S.,Warren, A.(2006). Scientific abilities and their assessment. Physical Review Special Topics-Physics Education Research, 2(2), 020103. https://doi.org/10.1103/PhysRevSTPER.2.020103

[4] Formica, S.P., Easley, J.L., & Spraker, M.C.(2010). Transforming commonsense beliefs into Newtonian thinking through Just In Time Teaching. Physical Review Special Topics-Physics Education Research,6(2),020106. https://doi.org/10.1103/PhysRevSTPER.6.020106.

[5] Halloun, I.A., & Hestenes, D.(1985).Common-sense concepts about motion. American Journal of Physics,53(11), 1056–1065. https://doi.org/10.1119/1.14031.

Hammer, D.(2000). Student resources for learning intro-ductory physics. American Journal of Physics, 68(S1), S52–S59. https://doi.org/10.1119/1.19520

[7] Hestenes, D., Wells, M., & Swackhamer, G.(1992). Force concept in ventory. The Physics Teacher, 30(3), 141–158. https://doi.org/10.1119/1.2343497

[8] Holzner, S.(2006). bySteven Holzner(1sted.). Indianapolis: Wiley Publishing, Inc.

[9] Kuo, E., Hull, M.M., Gupta, A., & Elby, A.(2013). How students blend conceptual and formal mathematical reasoning in solving physics problems. Science Education, 97(1), 32–57. https://doi.org/10.1002/sce.21043.

[10] Lin, S.Y., & Singh, C.(2015). Effect of scaffolding on helping introductory physics students solve quantita-tive problems in volving strong alternative concep-tions. Physical Review Special Topics-Physics Education Research,11(2),020105. https://doi.org/10.1103/PhysRevSTPER.11.020105

[11] Malone, K. L.(2008). Correlations among knowledge structures, force concept inventory, and problem solving behaviors. Physical Review Special Topics– Physics Education Research, 4(2), 020107. https://doi.org/10.1103/PhysRevSTPER.4.020107.

[12] Maloney, D. P.(1984). Rule-governed approaches to physics - Newton's third law. Physics Education, 19(1),37–42. https://doi.org/10.1088/0031-9120/19/1/319

[13] Potgieter, M., Malatje, E., Gaigher, E., & Venter,E.(2010). Confidence versus performance as an indicator of the presence of alternative conceptions and inad-equate problem solving skills in mechanics. Interna-tional Journal of Science Education, 32(11), 1407–1429. https://doi.org/10.1080/09500690903100265

[14] Thornton, R.K., & Sokoloff, D.R.(1998). Assessing student learning of Newton's laws: The force and motion conceptual evaluation and the evaluation ofactive learning laboratory and lecture curricula. American Journal of Physics,66(4),338–352. https://doi.org/10.1119/1.18863

[15] Walsh, L. N., Howard, R.G., & Bowe, B.(2007). Phenomeno graphic study of students' problem solving approaches in physics. Physical Review Special Topics- Physics Education Research, 3(2), 020108. https://doi.org/10.1103/PhysRevSTPER.3020108

ABOUT THE AUTHORS

Indri Dayana received S. Si degree in Physic from Medan State University in 2004, and M.Si. degree in Physic from University Sumatera Utara, Indonesia, in 2015 and Dr. degree from Universitas Sumatera Utara in 2021. She is currently a lecture in Dept. of Electrical Engineering, Universitas Medan Area, Indonesia. His research interests are physic, material, energy and electro.

Habib Satria received B.Sc degree in electrical engineering education from Padang State University in 2016, and M.T. degree in electrical engineering from University Andalas, Indonesia, in 2018and Engineer professional (Ir). degree from UniversitasDiponegoro in 2022. He is currently a lecture in Dept. of Electrical Engineering, Universitas Medan Area, Indonesia. His research interests are new and renewable energy, concerning about solar power plant, automatic control system, real- time simulation and power system.He is a member of the IAENG (International Association of Engineers) and The Institution of Engineers Indonesia.

YUDI received S.Kom degree in computer information system from Potensi Utama University in 2010, and M.Kom. magister in computer information system from Putra Indonesia University, Padang, Indonesia, in 2014. He is currently a lecturer in Dept. of computer information system, Potensi Utama University, Medan, Indonesia. His research interests are science and technology computer, concerning about science and technology, computer system, geografic information system, system human resources.