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Submission 5532	
Title	Numerical Analysis of the Influence of Iron Type on Von Mises Stress and Safety Parameters for Compost Processing Machine Frame Construction
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Author keywords	Solidwork Von Mises Safety Factor Static Structure
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Abstract	The installation of other engine parts, such as the engine, transmission, shaft, blade, and cover, includes the engine frame. The engine frame must be developed and constructed with strength in order to support other components. The building of the waste processing machine frame with variants of square tube type and angle bar type will be analyzed in this study, with a focus on the analysis of von Mises stress and safety aspects. Using Solidworks software, finite element analysis is the research methodology used. The examination of the waste processing machine's frame modeling using square tubes and angular bars yielded maximum von Mises stress values of $3.77e+7$ N/m ² and $3.162e+4$ N/m ² , respectively. The maximum deformation values for the square tube iron and angular bar used in the modeling analysis of the waste processing machine frame are $2.499e+1$ mm and $9.725e+1$ mm, respectively, and 8.5 and 1 is the required minimum safety factor value for modeling the frame of a waste processing machine made of square tube iron. The safety factor value of 2-3 is the primary criteria for a suitable design. It is safe and advised to utilize the waste processing machine frame made of square tube iron for this purpose.
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Reviews

Review 1	
1: (weak accept (major revision))	This paper analyzed waste processing machine frames with variants of square tube type and angle bar type



Reviews

Review 1	
1: (weak accept (major revision))	This paper analyzed waste processing machine frames with variants of square tube type and angle bar type using Solidworks software, with a focus on the analysis of von Mises stress and safety aspects.
Overall evaluation	Below is the input for revision: 1. Paper structure: (a). Contribution of the paper to scientific development ==> GOOD (b). Originality and readability ==> FAIR (c). Resolution of graphics, tables, and correct citation ==> FAIR (d). The full paper should contain "Introduction, Methodology, Results, and Discussion (IMRAD)" ==> GOOD (e). The format and the preparation of the manuscript should follow the publisher's guidelines for authors (Instruction for Authors) ==> FAIR 2. The text in Figures 1 to 3 is not clear. There is a double of Figure 3. 3. We cannot see the result of dynamic analysis clearly. What are the dynamic parameters used here? 4. Better in Section 2, the author provides a block diagram or flowchart to see and understand what to be simulated, and what to be the results estimated for further optimization. 5. Please provide the contract number for Higher Education Community Service Grant program for 2022 in the Acknowledgements 6. Please strictly write the paper following the IDP EES template and format, for example, spacing, font, indenting, etc.
The relevance (scope) of the manuscript	4: (good)
Paper structure	3: (fair)

Review 2	
2: (accept (minor revision))	I recommend revision on english (Paper language) as the existing language used to determine the factors looks very basic.
Overall evaluation	
The relevance (scope) of the manuscript	3: (fair)
Paper structure	3: (fair)

Review 3	
2: (accept (minor revision))	1. For the structure
Overall evaluation	
The relevance (scope) of the manuscript	
Paper structure	



Acknowledgements	
6. Please strictly write the paper following the IOP EES template and format, for example, spacing, font, indenting, etc.	
The relevance (scope) of the manuscript	4: (good)
Paper structure	3: (fair)
Review 2	
Overall evaluation	2: (accept (minor revision)) I recommend revision on english (Paper language) as the existing language used to determine the factors looks very basic.
The relevance (scope) of the manuscript	3: (fair)
Paper structure	3: (fair)
Review 3	
Overall evaluation	2: (accept (minor revision)) 1. For the structure (a). Contribution of the paper to the scientific development. [Good] (b). Originality and readability. [Good] (c). Resolution of graphics, tables, and correct citation. [Good] (d). Full paper should contains "Introduction, Methodology, Results, and Discussion (IMRaD)". [Good] (e). The format and the preparation of the manuscript should follow the publisher's guidelines for authors (Instruction for Authors). [Good] 2. Title: The title can be rearranged by reducing the conjunction "of." 3. Corresponding author's e-mail should be based on ITNY affiliation. This article, after publication, can be indexed through various databases [publon, Sinta, Google scholar &, etc.] 4. Methodology: The sentence structure is presented in the past, not in the present. Please correct the grammar 5. Fig 1. The number on the size indication is not clear. The color used [number] is like an article 6 Fig 1-Fig 4 is too small and unclear to be corrected. 7. Fig 3, presented twice
The relevance (scope) of the manuscript	4: (good)
Paper structure	4: (good)

Numerical Analysis of the Influence Iron Type on Von Mises Stress and Safety Parameters for Compost Processing Machine Frame Construction

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Abstract

The installation of other engine parts, such as the engine, transmission, shaft, blade, and cover, includes the engine frame. The engine frame must be developed and constructed with the strength to support other components. The building of the waste processing machine frame with variants of square tube type and angle bar type will be analyzed in this study, with a focus on the analysis of von Mises's stress and safety aspects. Using Solidworks software, finite element analysis is the research methodology used. The examination of the waste processing machine's frame modelling using square tubes and angular bars yielded maximum von Mises stress values of $3.77e+7$ N/m² and $3.162e+4$ N/m², respectively. The maximum deformation values for the square tube iron and angular bar used in the modelling analysis of the waste processing machine frame are $2.499e+1$ mm and $9.725e+1$ mm, respectively. and 8.5 and 1 is the required minimum safety factor value for modelling the frame of a waste processing machine made of square tube iron. The safety factor value of 2-3 is the primary criterion for a suitable design. It is safe and advised to utilize the waste processing machine frame made of square tube iron for this purpose.

Keywords: Solidowork, Von Misses, Safety Factor, Static Structure.

1. INTRODUCTION

It takes a machine to efficiently and cheaply process garbage to turn it into compost [1]. Waste management technology was developed as a result of the quick development of technology to produce a secure and pleasant environment. Composting, using organic waste as fuel, and bioenergy plants are three ways to recycle garbage [2]. It is vital to have the machinery to grind and shred organic waste into small bits for degradation of materials by microorganisms to improve and accelerate the composting process and generate compost [3]. Different composting devices are created and intended to make it easier to process organic waste for composting to reduce kitchen waste, etc. [2]. The machine for decomposing agricultural trash to create compost from coir and areca leaves was also invented, according to another study [4]. To improve and develop agricultural production economically, another study created machinery to crush crop leftovers [5].

The waste processing device is made up of many parts, such as engine frames, transmission systems, hoppers, and knife housings. The installation of other engine parts, such as the engine, transmission, shaft, blade, and cover, includes the engine frame. The engine frame must be sturdy and well-designed for it to sustain other parts that are attached to it. It was outlined in earlier research that ease, security, and comfort during use particularly concerning the engine framework are characteristics that need to be taken into account when designing the design [6]. The supplied load must also be taken into account while designing the engine because it may result in vibration, excessive thrust, or overload, which would exert an inertial force on the entire frame [7].

The primary steps in the manufacture of machines with the aid of CAD technology are chosen to reduce the likelihood of errors occurring during the creation of a product's design [8]. Additionally, design flaws can be reduced by improving the design using numerical simulation [9]. Construction, mechanical, and other structural businesses frequently use this technique [10]. Software like Solidwork and ANSYS [11], [12] are just two examples of the various tools available to designers to assist them to overcome technical issues.

The goal of this study is to perform dynamic analysis, particularly the analysis of von Mises stress and safety factors for the construction of the waste processing machine frame with variations in the type of square tube and type of angle bar used in making the waste processing machine frame, under the

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description given above. We require the use of SolidWorks software and a finite element technique to analyze the stresses and strengths of the proposed design. According to research [12], the software is a useful tool for using finite element analysis techniques to solve challenging situations. Researchers frequently use this technique to study stress [13], von misses, displacement, and safety factors [14], [15], optimize design, perform theoretical calculations [16], forecast a material's strength, and validate a force [17] using numerical simulations.

2. METHODOLOGY

Pre-processing, processing, and post-processing are the simulation techniques for modelling the waste processing machine framework using ANSYS software [18]–[21]. Using CAD software, the design is modelled during the pre-processing step, together with the material choices and physical attributes. Design modelling will be done at the processing stage using a math solver that follows the laws of elementary physics. The results of the calculations performed by the Solidwork program will be examined and verified by specialists during the post-processing phase, which is the final stage [15].

2.1 Pemodelan Simulasi

With the use of SolidWorks 2022 software, a compost processing machine frame simulation was created for this study. Next, the computational domain division (mesh) was performed to obtain convergent results when the analysis was run [19]. Tetrahedral mesh is the type of mesh used in this study since it makes calculations simpler. Mild steel was chosen as the material because it is affordable and strong [22]. As illustrated in Figure 1, the square tube type and the angle bar type of frames are used in the waste processing machine that will be compared. The next steps are parameter selection, pedestal positioning, and loading selection. Table 1 provides an overview of this study's parameters.

Table 1. Parameters for skeletal simulation modelling

Description	Type Square Tube	Type Angle Bar
Young's Modulus	200 GPa	200 GPa
Poisson's Ratio	0,31	0,31
Density	7750 Kg/m ³	7750 Kg/m ³
Tensile Yield Strength	320 MPa	320 MPa
Tensile Ultimate Strength	400 MPa	400 MPa
Analysis Type	Static	Static
Node	326	456
Element	316	446
Load Machine	800 N	800 N
Load Shaft	100 N	100 N
Type Mesh	Tetrahedral Mesh	Tetrahedral Mesh
Length	40 mm	35 mm
Width	40 mm	35 mm
Thickness	4 mm	5 mm

2.2 Finite Element Method

Differential equations with a mechanical continuum can be used to describe occurrences in the scientific and engineering fields. Due to the nature of the material, boundary conditions, and structure, it is typically highly challenging to solve a partial differential equation analytically [23]. Physical issues are among the issues that the finite element approach can resolve. The finite element approach can be used to tackle the following categories of physical issues: structural analysis, buckling analysis, and vibration analysis [24], [25]. Structural analysis is a common application of the finite element method, which was chosen because the types of structures utilized don't just include those found in buildings and bridges but also include aeronautical, naval, and mechanical structures. Linear or nonlinear static structural analysis is possible [26], [27]. It is possible to assess a structure's failure to reduce the error function, generate a stable solution, and address technical issues [27].

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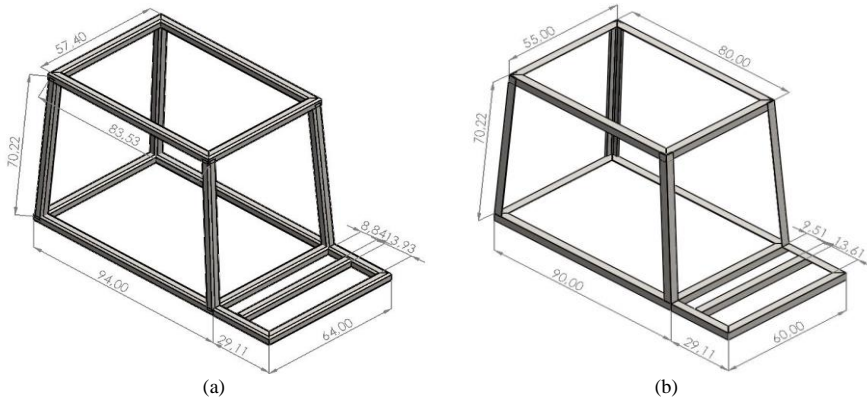


Figure 1. Iron is used to build the frame of the waste processing equipment
(a) Square tube and (b) Angle bar.

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3. RESULTS AND DISCUSSION

3.1 Von Mises Stress

The equivalent von Mises stress and equivalent plastic strain show that von Mises stress and strain play a significant role in numerical simulations for the ductile fracture of metal [28]. When the process is operating, the von Mises stress determines if a material is secure or will fail [29]. If the stress value exceeds the material's strength, the von Mises stress is said to have failed [15]. Figure 2 depicts the distribution of the static stress contour on the waste processing machine's frame made of an angle bar and a square tube iron. When compared to Figure 2 (b) on the left, the colour contour in Figure 2 (a) on the left lower frame tends to be light blue. A voltage differential is shown by the left lower frame's propensity to be dark blue in hue [15].

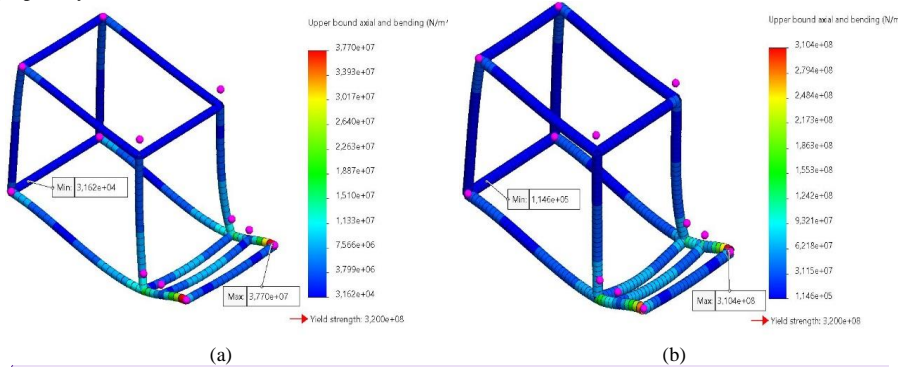


Figure 2. Results of the static stress distribution on the iron frame of the waste processing machine
(a) Square tube and (b) Angle bar.

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The maximum and minimum von misses stress values in the simulation modelling the waste processing machine frame using a square tube type of iron with a load of 100N and 750N are $3.77e+7$ N/m² and $3.162e+4$ N/m², while these values are $3.104e+8$ N/m² and $1.146e+5$ N/m² in the simulation of the same frame without the square tube type of iron and the two loads. As the provided load is increased, the value of von misses will also increase, and the stress value is inversely related to the applied force [30].

3.2 Deformation

One of the key markers of whether a material can bear a load is deformation. When an object experiences force, deformation may result [31]. Figure 3 displays the simulation outcomes for modelling the waste processing machine frame using a square tube and an angle bar with loads of 100N

and 750N. Figure 3(arrange)'s colour contour on the lower right frame of the contour and Figure 3 (yellowish)'s colour contour on the right frame beneath the contour show that the form has changed as a result of the loading and the design of the frame utilized.

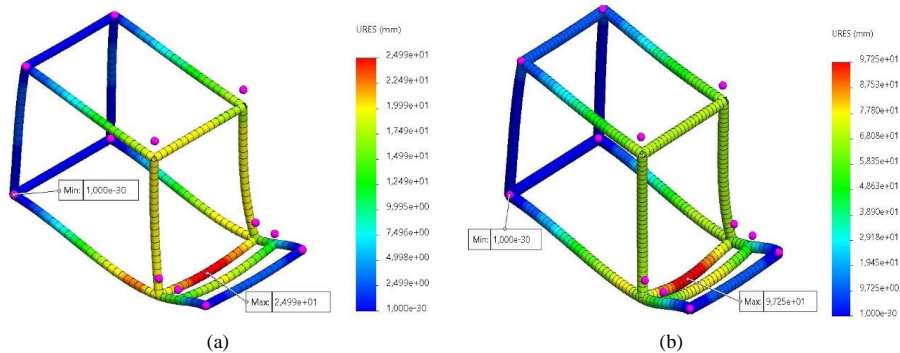


Figure 3. The outcomes of the displacement dispersion of the iron-framed waste processing machine (a) Square tube and (b) Angle bar

While the maximum and minimum von misses stress values in the simulation modelling of the waste processing machine frame use an iron type. angle bar with a load of 100N and 750N of $9.725e+1$ mm and $1e-30$ mm, respectively, the maximum and minimum displacement values use a square tube type of iron with a load of 100N and 750N of $2.499e+1$ mm and $1e-30$ mm. This demonstrates that a large load on the component does not result in significant deformation and that the component will be damaged if the frame cannot support the load [31].

3.3 Safety Factor

A designer will use the safety factor as a starting point when determining how much stress an object can withstand [32]. Figure 4 displays the simulation outcomes for modelling the waste processing machine frame utilizing square tube iron and angle bar with loads of 100N and 750N. Figure 4 (a) right frame colour contour is yellowish, whereas Figure 4 (b) frame colour contour is red, indicating that the shape of the contour has changed as a result of loading and the design of the frame utilized.

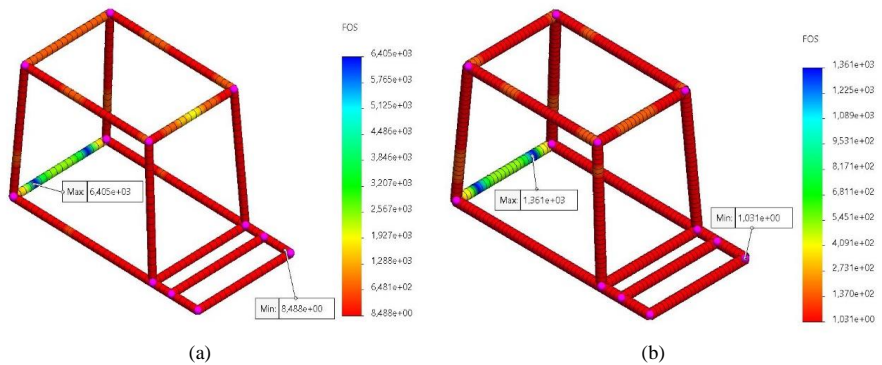


Figure 4. The outcomes of distributing the safety factor of an iron-framed waste processing machine (a) Square tube and (b) Angle bar

When employing square tube iron, the waste processing machine's frame must have a minimum safety factor of 8.5, whereas an angle bar iron frame must have a minimum safety factor of 1. A material that can endure dynamic loads has a safety value between 2-3 [33]. This demonstrates that while the waste processing machine frame made of angle bar iron is not safe to use for the waste processing machine frame, the simulation modelling of the waste processing machine frame made of square tube iron has a safety factor value that is. Numerous elements affect the safety factor when designing a modelling

simulation. [32] The accuracy of the calculated load, the usage environment, the material's quality and craft, and the requirements for plastic deformation and stiffness, according to scholars, may be grouped into four categories as the primary factors.

4. CONCLUSION

Based on the results of the analysis and simulation of the modelling of the waste processing machine frame using the type of iron square tube and angular bar, it can be concluded that:

1. The maximum von mises stress value for the frame of the waste processing machine using square tube and angular bar iron is $3.77e+7$ N/m² and $3.162e+4$ N/m².
2. The maximum deformation value of the frame of the waste processing machine using a square tube and angular bar is $2.499e+1$ mm and $9.725e+1$ mm.
3. The minimum safety factor value for the frame of the waste processing machine using square tube iron and angular bar is 8.5 and 1.
4. In this research simulation, the safest and most recommended waste processing machine frame is to use a square tube iron type because the safety factor value is above 2-3. Meanwhile, the frame of an unsafe waste processing machine is to use angular bar iron because the safety factor value is below the required value, namely 2-3.

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REFERENCES

- [1] N. O. Adepo, S. O; Obanoyen, "Design and construction of a plastic crushing machine," *Int. J. Nat. Appl. Sci.*, vol. 3, no. 4, pp. 8190–8193, 2009, doi: 10.4314/ijonas.v3i4.36228.
- [2] E. Pavankumar, S. Baskaran, R. Prithivirajan, S. Vinoth Kumar, and A. Karpagaraj, "Development of Multi-functioning Organic Waste Shredding Machine for Natural Compost," in *Advances in Industrial Automation and Smart Manufacturing*, Dr. A. Arockiarajan, Ed. Springer Nature Singapore Pte Ltd., 2021, pp. 1043–1055.
- [3] Siti, F,Z; Arouch, M; Beraich, F, A; Qanaldi, S, D, and Fassi, H, "DESIGN OF AN AUTONOMOUS SOLAR ROTARY COMPOSTER WITH SHREDDER SHAFT," *J. Southwest Jiating Univ.*, vol. 56, no. 5, pp. 46–51, 2021, doi: 10.35741/issn.0258-2724.56.5.33.
- [4] I. M. S. Kumar and D. T. R. H. Kumar, "Design and Development Of Agricultural Waste Shredder Machine," *Int. J. Innov. Sci. Eng. Technol.*, vol. 2, no. 10, pp. 164–172, 2015.
- [5] A. Katiyar, A. Gaur, and M. G. Kaur, "Design and Construction of a Shredding Machine for Recycling and Management of Organic Waste," *Int. J. Trend Sci. Res. Dev.*, vol. Volume-3, no. Issue-4, pp. 707–712, 2019, doi: 10.31142/ijtsrd23889.
- [6] M. Awwaluddin, "Analisa Kekuatan Rangka Sepeda Listrik Menggunakan Software SolidWorks," *Pist. J. Tech. Eng.*, vol. 3, no. 1, pp. 5–16, 2019, doi: <http://dx.doi.org/10.32493/pjite.v3i1.7486>.
- [7] P. D. Soden, B. A. Adeyefa, Y. S. Wong, and M. A. Millar, "Loads, Stresses, and deflections in Bicycle Frames," *J. Strain Anal. Eng. Des.*, vol. 21, no. 4, pp. 185–195, 1986, doi: 10.1243/03093247V214185.
- [8] D. Cekus, R. Gnatowska, P. Kwiaton, and M. Šofer, "Simulation research of a wind turbine using SolidWorks software," *J. Phys. Conf. Ser.*, vol. 1398, no. 1, 2019, doi: 10.1088/1742-6596/1398/1/012001.
- [9] G. M. Vegad and R. Yadav, "Design analysis and optimization of rotary tiller blades using computer software," *AMA, Agric. Mech. Asia, Africa Lat. Am.*, vol. 49, no. 1, pp. 43–49, 2018.
- [10] G. V. Gheorghe, C. Persu, I. Gageanu, and D. Cujbescu, "Structural and modal analysis in solidworks of basic structure of equipment to prepare germinative bed in strips," *Eng. Rural Dev.*, vol. 17, no. May, pp. 818–826, 2018, doi: 10.22616/ERDev2018.17.N064.
- [11] M. A. Al-Shammari and M. Al-Waily, "Analytical investigation of buckling behavior of honeycombs sandwich combined plate structure," *Int. J. Mech. Prod. Eng. Res. Dev.*, vol. 8, no.

- 4, pp. 803–818, 2018, doi: 10.24247/ijmperdaug201883.
- [12] M. A. Al-Shammari, Q. H. Bader, M. Al-Waily, and A. M. Hasson, “Fatigue behavior of steel beam coated with nanoparticles under high temperature,” *J. Mech. Eng. Res. Dev.*, vol. 43, no. 4, pp. 287–298, 2020.
- [13] M. J. Jweeg, H. A. Hamzah, M. Al-Waily, and M. A. Al-Shammari, “A Finite Element Simulation of Nano Effects on Stress Distribution in a Below Knee Prosthetic,” *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 1067, no. 1, p. 012141, 2021, doi: 10.1088/1757-899x/1067/1/012141.
- [14] S. Lu, H. Jin, M. He, and Z. Xu, “Analysis system of power tiller’s general machine components based on VB and ANSYS,” *J. Phys. Conf. Ser.*, vol. 1237, no. 4, pp. 1–6, 2019, doi: 10.1088/1742-6596/1237/4/042054.
- [15] A. B. Prasetyo, K. A. Sekarjati, and S. Haryo, “Design And Analysis of The Effect of Variation Ofcompression Force on Allen Key Using Finite Element Analysis Method,” *SJME Kinemat.*, vol. 7, no. 1, pp. 39–52, 2022, doi: 10.20527/sjmekinematika.v7i.
- [16] Q. Lai, Q. Yu, and J. Dong, “Dynamic analysis of rotary tiller gearbox based on EDEM, ADAMS and ANSYS,” *J. Intell. Fuzzy Syst.*, vol. 36, no. 2, pp. 1153–1160, 2019, doi: 10.3233/JIFS-169889.
- [17] H. Azimi-Nejadian, S. H. Karparvarfard, M. Naderi-Boldaji, and H. Rahmanian-Koushkaki, “Combined finite element and statistical models for predicting force components on a cylindrical mouldboard plough,” *Biosyst. Eng.*, vol. 186, pp. 168–181, 2019, doi: 10.1016/j.biosystemseng.2019.07.007.
- [18] A. B. Prasetyo and F. Fauzun, “Numerical study of effect of cooling channel configuration and size on the product cooling effectiveness in the plastic injection molding,” *MATEC Web Conf.*, vol. 197, pp. 8–11, 2018, doi: 10.1051/mateconf/201819708019.
- [19] A. B. Prasetyo, A. A. Azmi, D. S. Pamuji, and R. Yaqin, “Pengaruh Perbedaan Mesh Terstruktur dan Mesh Tidak Terstruktur Pada Simulasi Sistem Pendinginan Mold Injeksi Produk Plastik,” *Pros. Nas. Rekayasa Teknol. Ind. dan Inf. XIV Tahun 2019*, vol. 2019, no. November, pp. 400–406, 2019.
- [20] A. B. Prasetyo, F. Fauzun, A. A. Azmi, and R. I. Yaqin, “Studi Numerik Kontur Pola Aliran Fluida Pendinginan Pada Mold Injeksi Molding,” *Infotekmesin*, vol. 12, no. 1, pp. 104–109, 2021, doi: 10.35970/infotekmesin.v12i1.493.
- [21] A. B. Prasetyo, “Manutech : Jurnal Teknologi Manufaktur Analisis Numerik Perpindahan Panas Pada Saluran Pendingin Plastik Injeksi Molding Menggunakan Polyhedral Mesh,” *Teknol. manufaktur*, vol. 11, no. 02, 2019.
- [22] P. R. Kubasad, “Numerical Analysis for a Bicycle Frame made of Mild Steel and Composite,” vol. 3, no. 4, pp. 40–46, 2018.
- [23] S. Y. Tadeuz Stolarski, Y. Nakasone, *Engineering Analysis with ANSYS Software*, 1st ed. Butterworth-Heinemann, 2006.
- [24] N. B. Dantulwar, R. G. Maske, and J. T. Patel, “Finite Element Analysis of Ball Valve Assembly for Earthquakes,” *Int. Conf. Ideas, Impact Innov. Mech. Eng.*, vol. 5, no. 6, pp. 1460–1467, 2017.
- [25] M. Popa, I. S.- Ștefan, B. Nicoleta, and G. Ipate, “FEM model for the study of agricultural soil compaction under the action of two-wheel tractor,” vol. 40, no. 1, pp. 38–40, 2021.
- [26] A. Ansys Release Documentation, “ANSYS Workbench Release 10.0,” *ANSYS Work. Release 10.0*, 2005, [Online]. Available: [http://kashanu.ac.ir/Files/Content/ANSYS Workbench.pdf](http://kashanu.ac.ir/Files/Content/ANSYS%20Workbench.pdf).
- [27] M. M. Doustdar and H. Kazemi, “Effects of fixed and dynamic mesh methods on simulation of stepped planing craft,” *J. Ocean Eng. Sci.*, vol. 4, no. 1, pp. 33–48, 2019, doi: 10.1016/j.joes.2018.12.005.
- [28] Y. Z. Wang, G. Q. Li, Y. B. Wang, and Y. F. Lyu, “Simplified method to identify full von Mises stress-strain curve of structural metals,” *J. Constr. Steel Res.*, vol. 181, p. 106624, 2021, doi: 10.1016/j.jcsr.2021.106624.
- [29] R. G. Karmankar, “Analysis of Von- Mises-Stress for Interference Fit and Pull- Out States By Using Finite Element Method,” *Int. Res. J. Eng. Technol.*, vol. 4, no. 11, pp. 1367–1374, 2017, doi: 10.13140/RG.2.2.26447.79520.
- [30] R. V. Petrova, *Introduction to Static Analysis Using SolidWorks Simulation*, 1th ed. New York: CRC Press Taylor & Francis Group, 2014.
- [31] J. L. H. Richard W. Hertzberg, Richard P. Vinci, *Deformation and Fracture Mechanics of*

Engineering Materials, 5th ed. Wiley, 2012.

- [32] X. Wang, Q. Shi, W. Fan, R. Wang, and L. Wang, "Comparison of the reliability-based and safety factor methods for structural design," *Appl. Math. Model.*, vol. 72, pp. 68–84, 2019, doi: 10.1016/j.apm.2019.03.018.
- [33] K. Z. V. Dobrovolsky, *Machine Elements : a textbook*. Moscow: Peace, 1973.