

Prototype Design and Research Collection

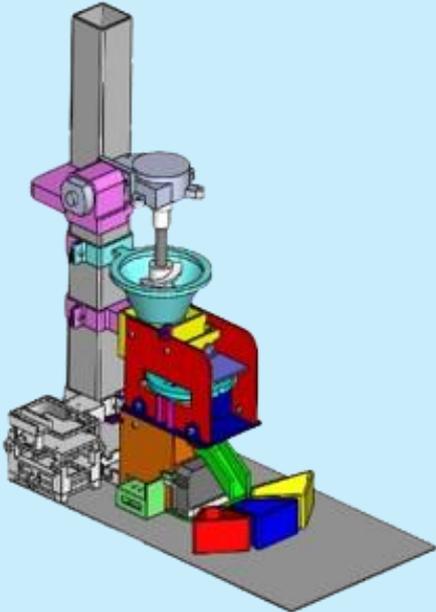
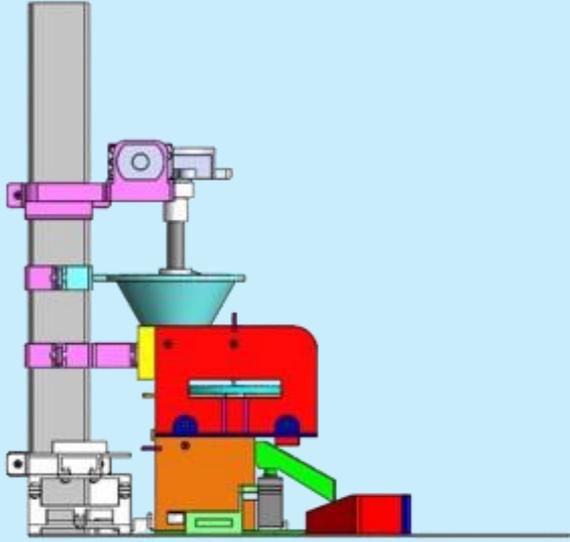
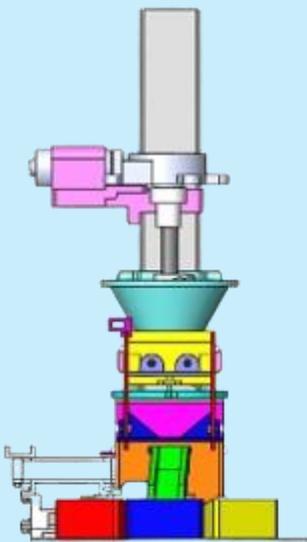
Series 1



Universiti Teknologi MARA
Pasar Gudang Campus

Prototype Design and Research Collection

Series 1



AHMAD NAJMIE RUSLI

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PUBLISHER:

Universiti Teknologi MARA
Cawangan Johor Kampus Pasir Gudang,
Jalan Purnama, Bandar Seri Alam, 81750 Masai, Johor
September 2025

eISBN: 978-967-0033-63-1

FOREWORD

This digital book on Prototype Design and Research Collection Series 1 (PDRC Series 1), is designed as a comprehensive reference for mechanical engineering students. The designs featured in this collection undergo an extensive analysis process, incorporating both prototype development and research to ensure a thorough understanding of design principles. Each project is carefully analysed before the prototype fabrication with detailed summaries of the project description and design parameters. The design and research products presented in this series cover a wide range of tools and equipment for various applications including household, workshop and entrepreneurial purposes.

This collection aims to foster innovation by offering students valuable insights into both the technical and research aspects of product design. It is hoped that this book will inspire future engineers and designers to approach product development with a deeper understanding of the design and research processes.

Table of Contents

CHAPTER 1	1
Development of a Motorized Skateboard Prototype	1
Nurzarifah Athirah Binti Zamanhuri ¹ and Kamariah binti Md Isa ^{2*}	1
CHAPTER 2	7
Designing and Development of a Rechargeable Screwdriver for Assembly Project	7
Yusuff Badrisyah bin Mohd Din ¹ and Ab Aziz bin Mohd Yusof ^{2*}	7
CHAPTER 3	14
Conceptual Design of a Multifunctional Barbeque Set	14
Syukri Amin Bin Rashid ¹ , Syahminisa Binti Nazri ² , Ahmad Nabil Ariff Bin Rafik Ahmad ³ , Syasya Umira Binti Shaharin ⁴ , Dmitri Luping Chong Qianlun ⁵ and Nur Aini Sabrin Binti Manssor ^{6*}	14
CHAPTER 4	23
Stress and Strain Analysis of Egg Yolk Separator	23
Norjasween Abdul Malik ¹ , Mohammed Khadzid Iman bin Mohammed Dzulhardy ² and Nurrul Amilin Zainal Abidin ^{3*}	23
CHAPTER 5	27
Innovative Design and Construction of a Mini Coin Sorter Device	27
Ikhwan Hafiz bin Hayaroni ¹ and Ab Aziz bin Mohd Yusof ^{2*}	27
CHAPTER 6	32
Mini Electric Sander Belt Machine: Design, Development, and Testing	32
Muhammad Bariq bin Mohd Bakhit ¹ and Ab Aziz bin Mohd Yusof ^{2*}	32
CHAPTER 7	36
Stress Analysis of Mini Compact Manually Operated Crane Design	36
Nurrul Amilin Zainal Abidin ¹ , Muhammad Irsyad bin Fauzi ² and Norjasween Abdul Malik ^{3*}	36
CHAPTER 8	39
Development of a Prototype Spray Paint Hut	39
Muhammad Farhan Mahadi ¹ and Nurul Hanna Mas'aud ^{2*}	39
CHAPTER 9	43
Development of An Automatic Barbeque Grill: A Prototype	43
Muhammad Nazirul Bin Mohd Sani ¹ and Mohd Ghazali Mohd Hamami ^{2*}	43
CHAPTER 10	51
Development of Adjustable Table Lifter Transport Using Hydraulic Jack	51
Amy Malissa bt Mohd Sam ¹ and Hazriel Faizal bin Pahroraaji ^{2*}	51
CHAPTER 11	56
Introducing the PrecisionFlex Grinder: A Revolutionary Adjustable Cutting Solution	56

CHAPTER 4

Stress and Strain Analysis of Egg Yolk Separator

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ABSTRACT

The design and fabrication of an egg yolk separator represent a significant advancement in kitchen utensils, aiming to streamline the process of separating egg yolks and whites efficiently. This project employs SolidWorks software for the design phase and subsequently fabricates and tests the designed egg yolk separator. The primary objectives include designing and fabricating a product capable of autonomously separating egg yolks and whites, thereby reducing the effort required by users during food preparation. The proposed egg yolk separator utilizes an ingenious design methodology. As the egg is broken directly over the starting point of the upper plane, it initiates a seamless process where the egg slides down. Gravitational force then comes into play, orchestrating the natural separation of the white egg from the yolk as they traverse through a strategically designed gap. This innovative approach ensures a simple yet effective means of egg yolk separation, enhancing the usability and efficiency of the proposed egg yolk separator. Additionally, this study will involve stress-strain analysis using SolidWorks to evaluate the structural integrity and performance of the egg yolk separator under different loading conditions. Integrating this analysis into the project will provide valuable insights into the performance and reliability of the product. By incorporating this methodology, the project aims to offer a promising solution to the challenges associated with traditional egg yolk separation methods, providing a user-friendly approach to streamline kitchen processes and improve overall productivity. As for conclusion, the egg yolk separator has been successfully designed and fabricated, hence mark a significant achievement in addressing the objectives of the project. The seamless operation and effectiveness of the separator underscore its potential to revolutionise egg yolk separation practices, contributing to enhanced efficiency and productivity in culinary environments.

Keywords: Egg yolk separator, Stress strain analysis

1 INTRODUCTION

Egg yolk separators serve as indispensable tools in various industries, particularly in food processing, where the separation of egg yolks from egg whites is a common requirement. The efficient operation of these separators hinges upon their structural integrity and mechanical performance under diverse stress conditions. The study focused into the intricate mechanics governing egg yolk separators, focusing on elucidating the stress and strain distribution within these devices to enhance their design, efficiency, and longevity. The

primary objective of this study is to design and fabricate an egg yolk separator. Specific objectives include the stress and strain analysis of to conduct a meticulous analysis of the stress and strain distribution within egg yolk separators under varying loading conditions

The findings of this study hold significant implications for the design and operation of egg yolk separators especially for small industries. By gaining a deeper understanding of the stress and strain behaviour within this devices, all the decisions regarding material selection, structural design, and operational parameters, can be made thus ultimately leading to improved performance, reduced maintenance costs, and enhanced sustainability.



Fig. 1: Final Product of Egg Yolk Separator

2 LITERATURE REVIEW

Eggs are a vital component of the human diet, serving as a cost-effective source of essential nutrients such as easily digestible proteins, lipids, minerals, and vitamins [1]. An egg product separating machine (egg breaking and separating machine), is a processing equipment that break eggs and separate their contents [2].The study conducted by [3] introduced an egg yolk separator comprising a strainer equipped with a segment designed to retain the egg yolk and an aperture for filtering the egg white. Additionally, the separator features a pair of arms extending in opposite directions from the strainer, intended for positioning on opposite sides of an opening vessel to secure the separator in place.

Egg yolk separators undergo a spectrum of mechanical forces during their operational lifecycle, including bending, torsion, and compression. Understanding the stress and strain dynamics within these separators is pivotal for ensuring their reliability and optimal performance. While previous research has explored various aspects of egg yolk separator design and functionality, a comprehensive analysis of the stress and strain behavior remains largely unexplored.

3 METHODOLOGY

The methodology employed in this study aims to design, analyse and fabricate an egg yolk separator. This study includes the analysis of stress and strain distribution within the egg yolk separator to enhance its design and functionality. The study starts with the design selection method, then the selected design was developed using SolidWorks CAD software. This software facilitated the creation of part drawings, assembly drawings, and 2D representations of the product. The design incorporated a strainer (upper plane) with a section dedicated to retaining the egg yolk and an aperture (lower plane) for straining the egg white. Additionally, a pair of legs extending from the strainer were designed to facilitate secure placement on opposite sides of an opening vessel. The stress and strain analysis was conducted by using SolidWorks Simulation, which allowed for the virtual testing of the separator under various loading conditions.

Following the design and analysis phases, the egg yolk separator has been successfully fabricated using appropriate materials and manufacturing techniques. The product is using galvanised sheet metal, a commonly used material known for its durability and corrosion resistance, through precision machining techniques. The pair of legs extending from the strainer were meticulously attached using nut and bolt, providing sturdy support for secure placement on the both upper and lower plane.

4 RESULTS AND DISCUSSION

The following section presents the results and discussion of our study on the stress and strain analysis of an egg yolk separator. Figure 1 and 2 show the stress and strain analysis for the leg for egg yolk separator. This analysis shows that the leg can support 100kN. Most of the parts remain blue. Generally, the overall stress does not exceed the yield stress of the leg which means the design will be able to withstand the load and it is safe to be used.

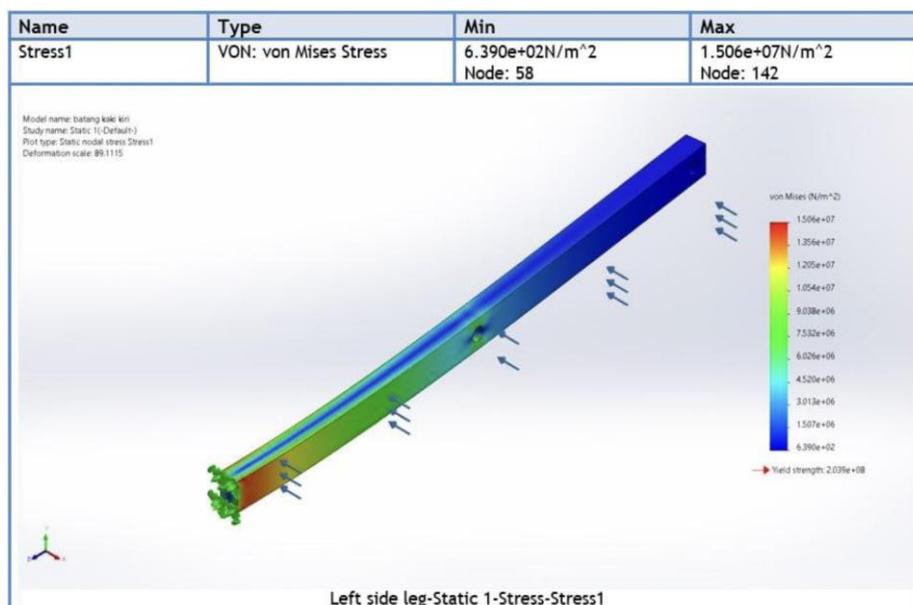


Fig. 1: Stress Analysis of Left Leg of the Egg Yolk Separator

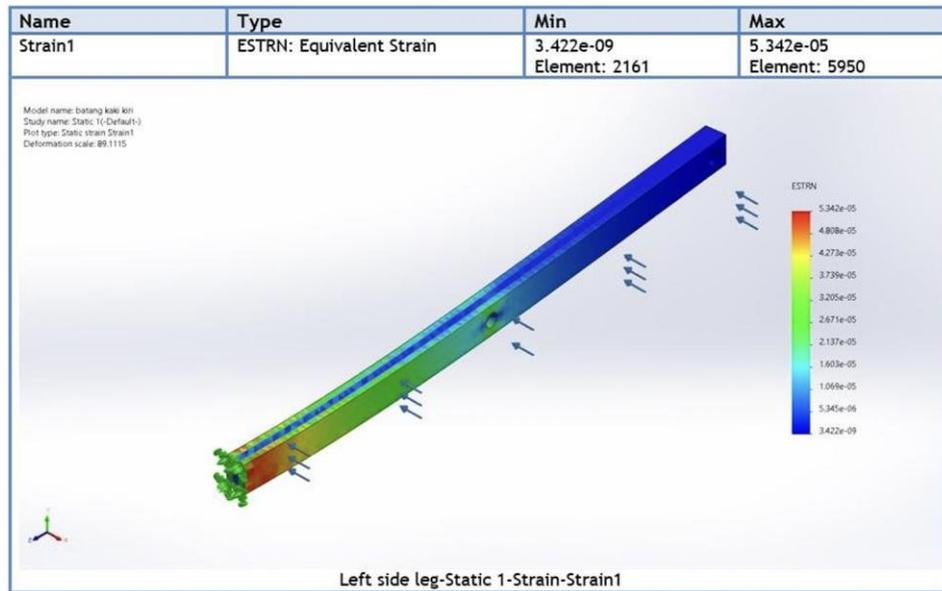


Fig. 1: Strain Analysis of Left Leg of the Egg Yolk Separator

5 CONCLUSIONS

In conclusion, the stress and strain analysis conducted using SolidWorks simulation tools provided valuable insights into the mechanical performance of the egg yolk separator. The results of this analysis have confirmed the design iterations, enabling researchers to fabricate the separator for enhanced efficiency and longevity in egg processing applications. The final results shows that the separator has been successfully fabricated and functioning well.

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