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# Design and Static Analysis Of A Phone Holder With Powerbank Unit

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***Abstract –*** With the development of technology and the virtual world, the time people spend with their phones and tablets has increased. As a result of the increase in technology consumption, products that will make our lives easier have entered. One of these products is a wooden phone holder. This product has been produced for us to watch movies, series or live broadcasts comfortably at home and outdoors. In this study, added a power bank unit in addition to the classic wooden phone holder. Designed it with Solidworks 2020 program and analyzed it with Ansys 2021 program. While doing the analysis, determined whether the product can be obtained safely with the maximum and minimum values.

*Keywords – Phone Holder, Design, Solidwork , Ansys Analysis*

## I. Introduction

The widespread use of mobile phones in the world began in the early 1990s has taken place. In these years, people started to replace fixed home phones. Individual phones were welcomed with enthusiasm. modern mobile phones has a different meaning in the world. In the increasingly individualized modern life every person is more liberated with the phone they have and with this He created a new identity for himself. The first mobile phones were only speech and Smartphones that emerged in the 2000s while allowing messaging by expanding the sphere of influence of globalization, borders are eliminated. Managed to remove it. As a milestone in the history of smartphones in 2007 met with an innovation described. Apple, led by Steve Jobs It launched the first iPhone model in history. Apple's iOS operating system iPhone, which was introduced to the market with the It brought together the large and touch-screen iPod and the Internet. The iPhone, which has the feature of having the first full touch screen, being a reference point for all smartphones introduced after it has character. In a short time, the world like Samsung, Nokia and LG similar calls have started to come from giants as well [1].

The market share of smartphones, reaching 80% in the USA and UK, is in Turkey it was 57 percent in 2015 [1, 2].

Intelligent with such a high utilization rate A lot of research is being done by various analysis companies regarding phones. This one of the studies is the European Mobile Analysis company Adjust on mobile applications. This is the research he conducted by including Turkey. Another study on the smart phone usage habits of the Z generation is in the USA. Made by AppAnnie. Smartphones of 3 different age groups In this study, which aimed to determine the usage habits of it has been revealed that the period of time has increased by 40 percent between 2014 and 2015. Also the same average number of applications open per day in time period 30 percent, session length increased by around 10 percent. Data consumption has also increased by around 85% [1, 2].

Access to information for today's people living in the information age has become easier than ever with the developing technology. While the rapid changes in the field of communication technologies affect individuals socially, culturally and physically, they create direct or indirect changes in people's lifestyles. Especially mobile phones emerged with certain functions in the early 1990s. [2].

Smartphones, which are the new inventions of humanity, make human life much easier thanks to their various features. Many important features such as speech, messaging, internet access, banking, camera, use of social media, calculator, flashlight, compass, notepad, e-book reader have made them very attractive. Now, almost every person has a smartphone in their hands and these phones are used extensively [3].

Thanks to these features, it has gained a special meaning compared to other technological tools. The smartphone has become a kind of "symbolization as a reflection of identity and style". From this context, it becomes possible to say that today's social reality is built from codes and software. Numbers, profiles, symbols, images, digital culture and many other things can be followed through social networks. The continuous production of codes and the constant renewal of the tools that provide this production are the harbingers of an era in which digitalization continues to rise. As Bookchin said, while technology was an extension of humanity, now humanity has become an extension of technology [4].

These developments in communication technologies also improve the capacities of smart phones and thus the limits of their usage areas [5].

However, this has led to some problems. Because it causes it to be considered as a need by people and spends hours on smart phones a day. Fear of not being able to meet this need or being deprived of the phone becomes a psychological disorder called nomophobia when it is excessive in the individual. This situation, which is also expressed as the withdrawal symptom dimension of smartphone addiction; constantly checking the smartphone without warning, anxiety due to deprivation, depression, tremor, increase in blood pressure, feeling of loneliness, increased heart rate, used more than 7 hours a day, preferring to use the smartphone despite being asocial, backup battery or charging behavior without deprivation It can turn into addiction in situations such as avoidance, using a smart phone to relieve negative mood, using it in the classroom, in the bathroom, before sleeping and while driving. For example, in a study conducted with 537 university students in Turkey, 42.6% of the participants were found to be nomophobic. When a fully charged smartphone battery is used continuously, one day is usually not enough and people have to charge their devices frequently. In solving this problem; It develops technical and engineering solutions such as creating wireless charging points, developing energy efficient devices and applications, and users do not remain silent against the limited lifetime of their batteries [6].

Phone holder is known as a phone accessory that has become a necessity in the age of technology. Like all other phone accessories, the phone holder is produced to make our lives easier (Fig. 1).

Fig. 1 Phone Holder

The biggest advantage of this accessory is that it allows you to use your phone comfortably in your hands-free position. In this way, watching movies and series on your phone and searching the internet becomes easier and more enjoyable. You put your phone on the stand and continue to do other work while you do. It is a wide range of accessories. For example; It is not possible to hold the phone in your hands while washing dishes, eating or preparing food, before going to sleep, while driving and working on the computer. In such cases, the phone holder appears as a hero, a savior. In this way, your phone remains stationary without moving and continues to serve its purpose.

## II. Materials and Method

In this study, we created the oak phone holder and power bank unit design using Solidworks 2020 program. Then we analyzed it using Ansys 2021 program. We took the force of the phone as 194 N and 26.5 degrees to the phone between holder. We applied its components depending on the angle of the phone force we received with the axis. We took the force applied by the power bank unit as 245 N. Two different analyzes were made, only the force applied by the phone and the force applied by the power bank unit together with the phone. Oak was used as material. Material properties of oak is seen in Fig. 2.

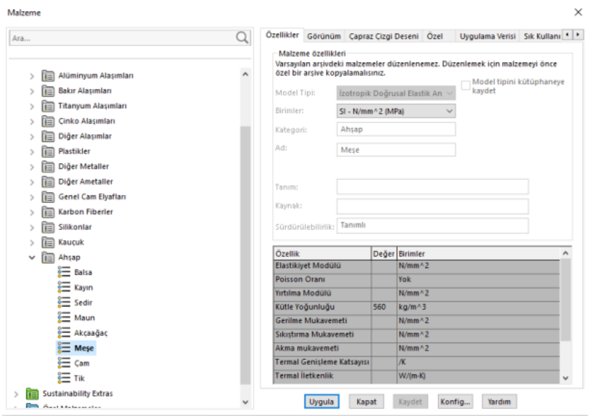

Fig. 2 Material Properties of OAK

## A. Solidworks Design

Solidworks design of phone holder with powerbank unit is seen Fig. 3 and Fig. 4.

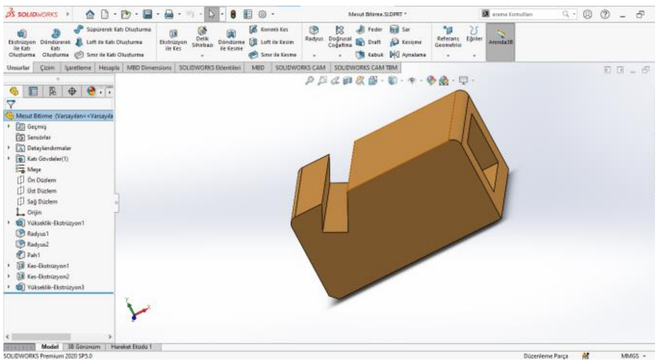

Fig. 3 Solidworks Design of Phone Holder

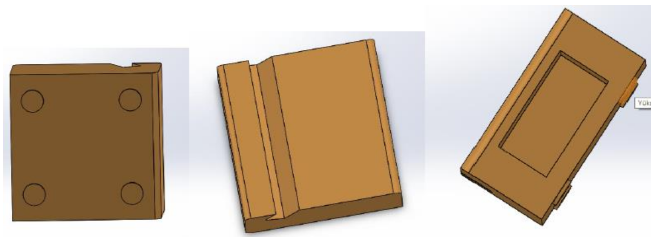

Fig. 4 Solidworks Design of Phone Holder

## B. Static Analysis

Definition; Static analysis helps development teams that are under pressure. Quality releases needed to be delivered on time. Coding and compliance standards need to be met. And mistakes are not an option. That’s why development teams are using static analysis tools. Here, we discuss static analysis and the benefits of using a static code analysis tool.

Von Mises Stress; Von Mises Stress criterion is one of the widely used criteria for designing ductile material engineering components. To judge if a design is within design limits and will work safely for its design life, Von Mises Stress Criteria prove to be highly effective. Von Mises stress concept is developed from the distortion energy theory and a highly preferred failure theory used in the mechanical design industry.

Shear Stress; Stress resulting from the application of opposing forces parallel to a cross-sectional area of a body.

Normal Stress; When the external force acts perpendicular to the cross-sectional area of any object or a body, it induces stress in those objects or a body to regain its original shape. The stress so produced by the perpendicular action of a force on a given area is called normal stress.

Maximum Shear Stress; Maximum shear stress theory is one of the theories of failure used for the safe design of mechanical components and it is suitable for a ductile material. The maximum shear stress theory is also called as Tresca theory of failure. The method is not suitable in hydrostatic stress conditions.

Deformation; In engineering mechanics, deformation is a change in shape due to an applied force.

# III. Results and Discussion

In this analysis, only phone force was used. Phone holder design was seen in Fig. 5.

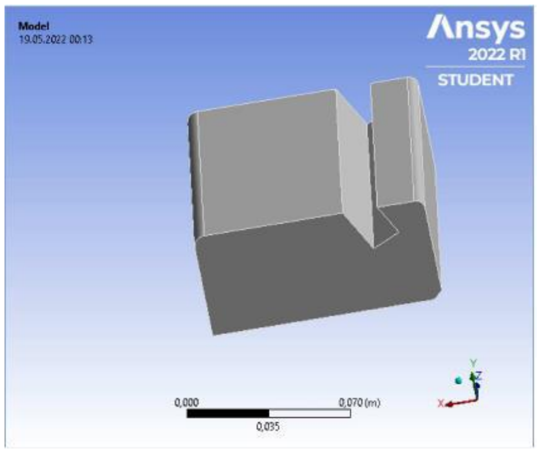


Fig. 5 Phone Holder Model

Static structural analysis results are given from Fig. 6 to Fig 17. The maximum total deformation was obtained as $5.71 \times 10^{-7}$ m. The maximum and minimum directional deformation (X-axis) was obtained as 5.1331x10$^{-7}$ m and -5.9974x10$^{-10}$ m, respectively. The maximum and minimum directional deformation (Y-axis) was obtained as 7.2091x10$^{-8}$ m and -2.5011x10$^{-7}$ m, respectively. The maximum and minimum directional deformation (Z-axis) was obtained as 8.7332x10$^{-8}$ m and -8.6784x10$^{-8}$ m, respectively. The maximum shear elastic strain was obtained as 1.5785x10$^{-5}$ m/m. The maximum and minimum equivalent elastic strain was obtained as 1.1269x10$^{-5}$ m/m and 7.4142x10$^{-9}$ m/m, respectively.

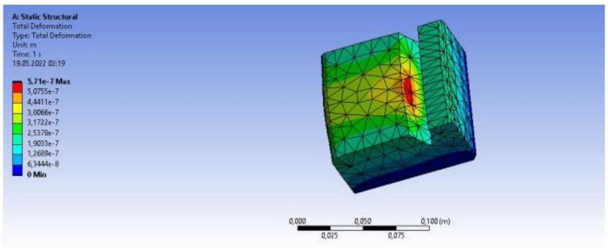

Fig. 6 Total deformation

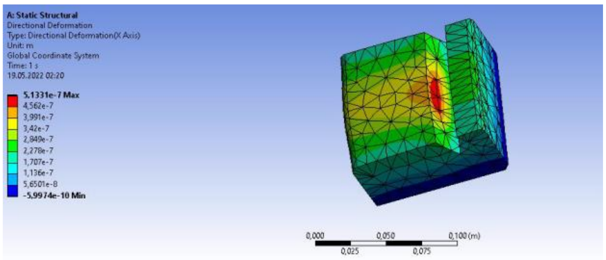

Fig. 7 Directional deformation (X-axis)

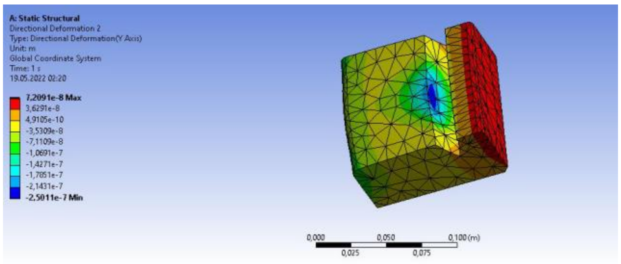

Fig. 8 Directional deformation (Y-axis)

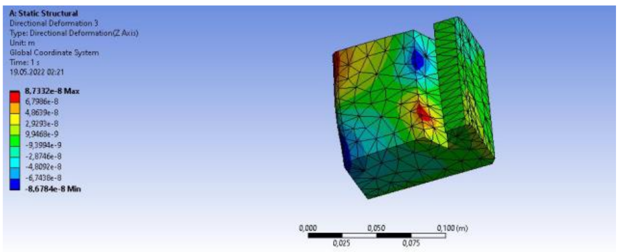

Fig. 9 Directional deformation (Z-axis)

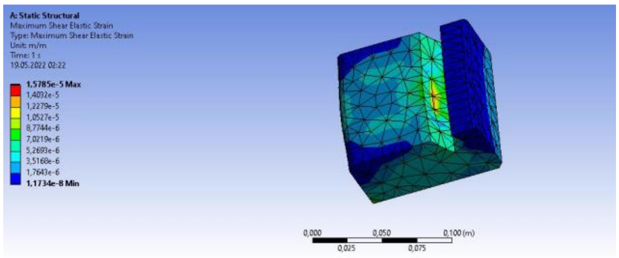

Fig. 10 Maximum shear elastic strain

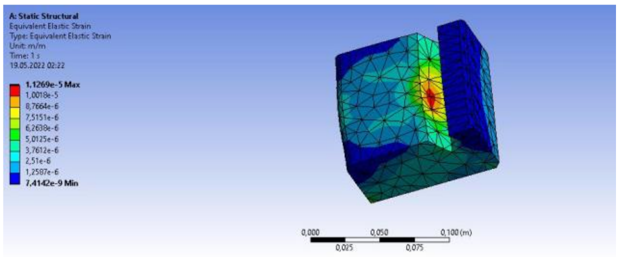

Fig. 11 Equivalent elastic strain

The maximum and minimum normal elastic strain (X-axis) was obtained as 5.891x10$^{-6}$ m/m and -4.8066x10$^{-6}$ m/m, respectively. The maximum and minimum normal stress (X-axis) was obtained as 1.6526x10$^{5}$ Pa and -1.5915x10$^{5}$ Pa, respectively. The maximum and minimum shear elastic strain (XY component) was obtained as 1.1526x10$^{-5}$ m/m and -1.1536x10$^{-5}$ m/m, respectively. The maximum and minimum shear stress (XY component) was obtained as 95532 Pa and -95619 Pa, respectively. The maximum and minimum equivalent (von-mises) stress was obtained as 2.3182x10$^{5}$ Pa and 168.9 Pa, respectively. The maximum shear stress was obtained as 1.3083x10$^{5}$ Pa.

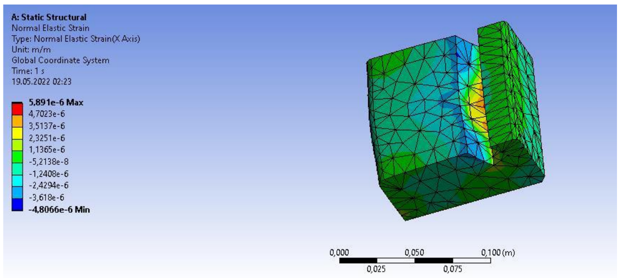

Fig. 12 Normal elastic strain (X-axis)

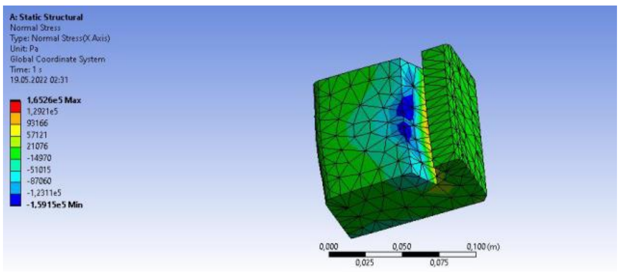

Fig. 13 Normal stress (X-axis)

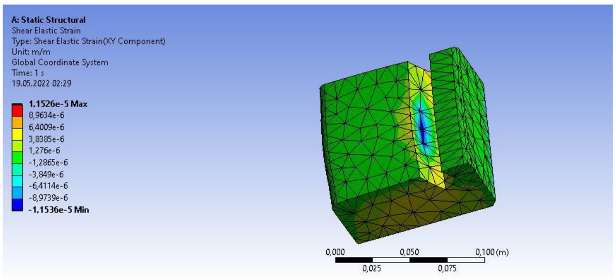

Fig. 14 Shear elastic strain (XY component)

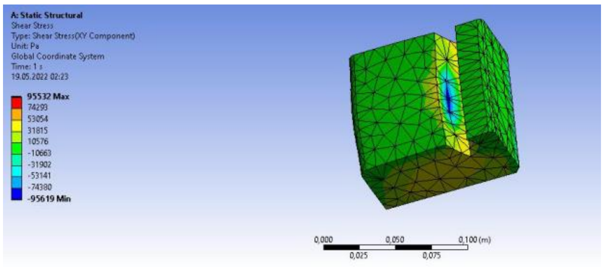

Fig. 15 Shear stress (XY component)

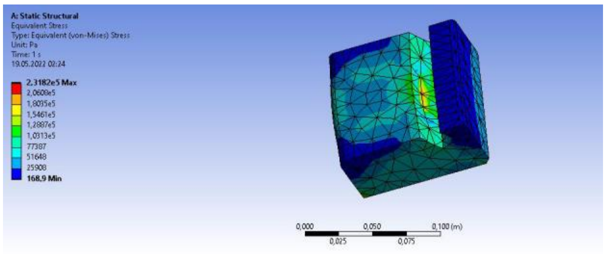

Fig. 16 Equivalent (von-mises) stress

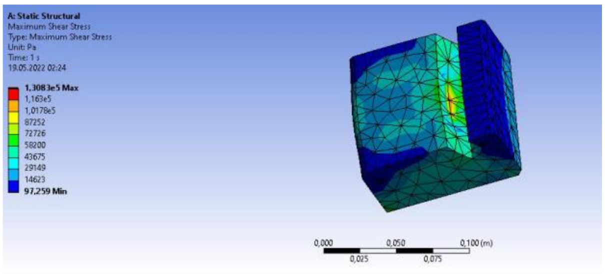

Fig. 17 Maximum shear stress

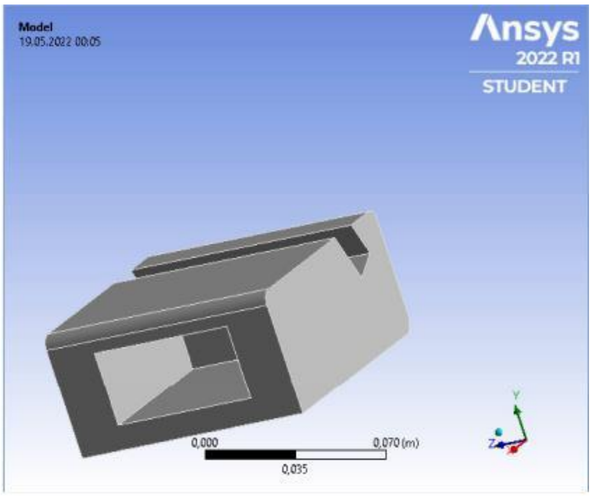


Fig. 18 Phone holder with powerbank model

In this analysis, telephone and power bank forces were used together. Phone holder with powerbank design was seen in Fig. 18.

Static structural analysis results are given from Fig. 19 to Fig 30. The maximum total deformation was obtained as 5.7282x10$^{-7}$ m. The maximum and minimum directional deformation (X-axis) was obtained as 5.1438x10$^{-7}$ m and -2.5668x10$^{-9}$ m, respectively. The maximum and minimum directional deformation (Y-axis) was obtained as 7.2869x10$^{-8}$ m and -2.5206x10$^{-7}$ m, respectively. The maximum and minimum directional deformation (Z-axis) was obtained as 8.8027x10$^{-8}$ m and -8.7441x10$^{-8}$ m, respectively.

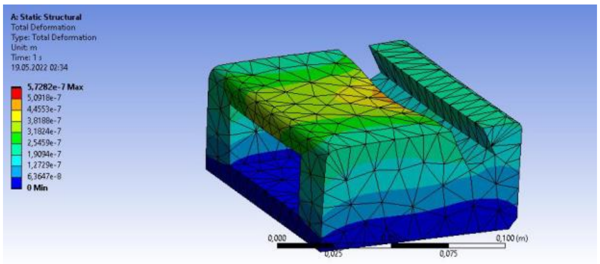

Fig. 19 Total deformation

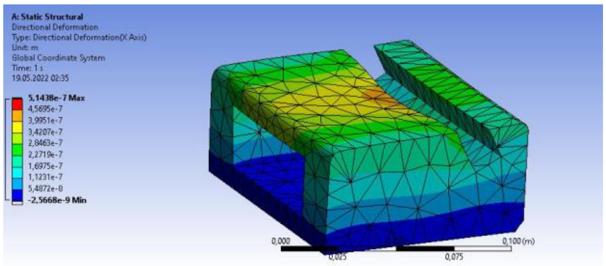

Fig. 20 Directional deformation (X-axis)

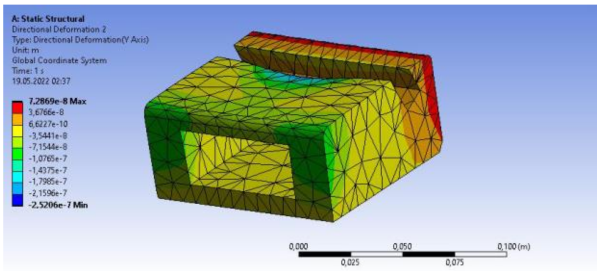

Fig. 21 Directional deformation (Y-axis)

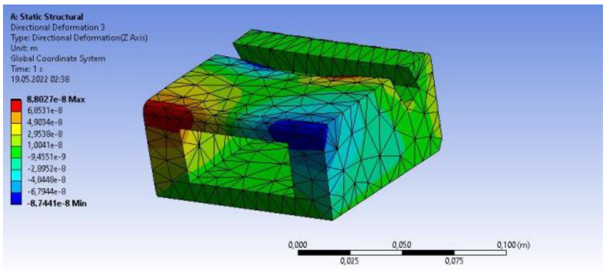

Fig. 22 Directional deformation (Z-axis)

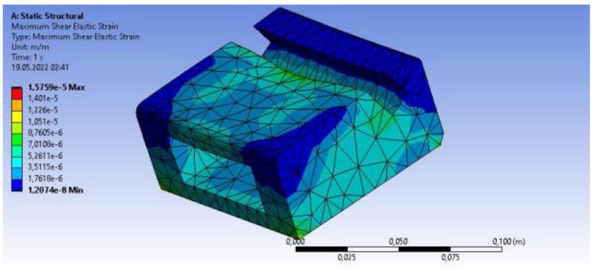

Fig. 23 Maximum shear elastic strain

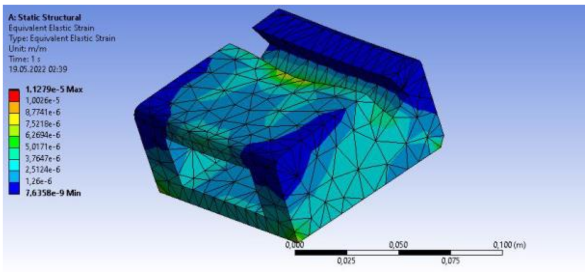

Fig. 24 Equivalent elastic strain

The maximum shear elastic strain was obtained as $1.5759x10^{-5}$ m/m. The maximum and minimum equivalent elastic strain was obtained as $1.1279x10^{-5}$ m/m and $7.6358x10^{-9}$ m/m, respectively. The maximum and minimum normal elastic strain (X-axis) was obtained as $5.8884x10^{-6}$ m/m and $-4.8125x10^{-6}$ m/m, respectively. The maximum and minimum normal stress (X-axis) was obtained as $1.6598x10^{5}$ Pa and $-1.6516x10^{5}$ Pa, respectively. The maximum and minimum shear elastic strain (XY component) was obtained as $1.1537x10^{-5}$ m/m and $-1.1565x10^{-5}$ m/m, respectively. The maximum and minimum shear stress (XY component) was obtained as 95626 Pa and -95859 Pa, respectively. The maximum and minimum equivalent (von-mises) stress was obtained as $2.3147x10^{5}$ Pa and 173.94 Pa, respectively. The maximum shear stress was obtained as $1.3062x10^{5}$ Pa.

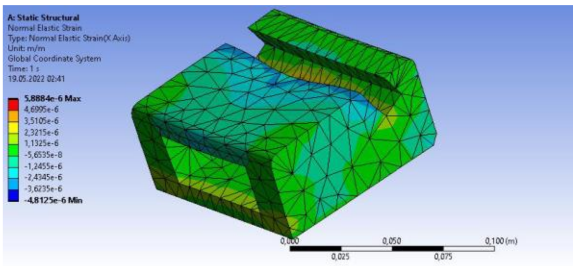

Fig. 25 Normal elastic strain (X-axis)

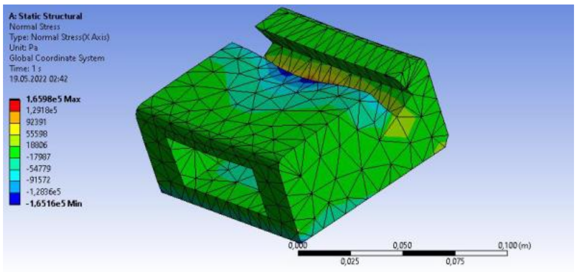

Fig. 26 Normal stress (X-axis)

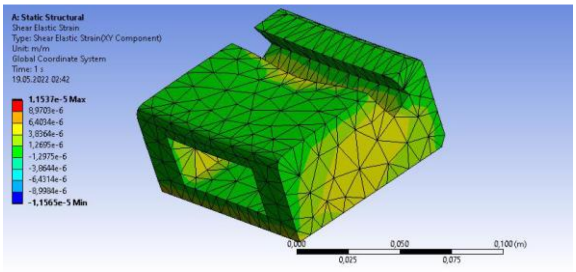

Fig. 27 Shear elastic strain (XY component)

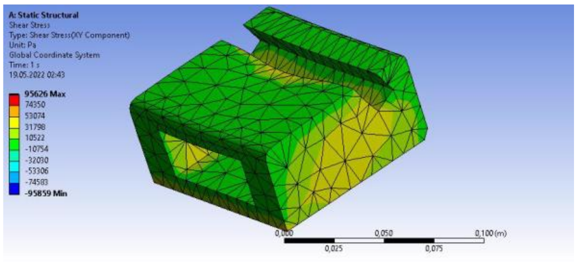

Fig. 28 Shear stress (XY component)

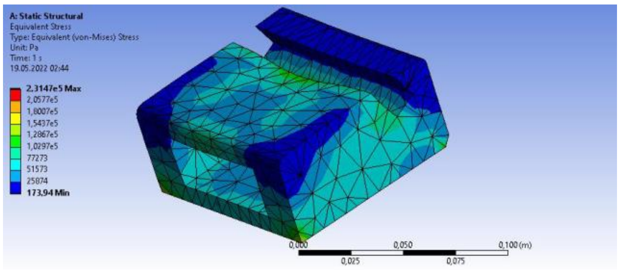

Fig. 29 Equivalent (von-mises) stress

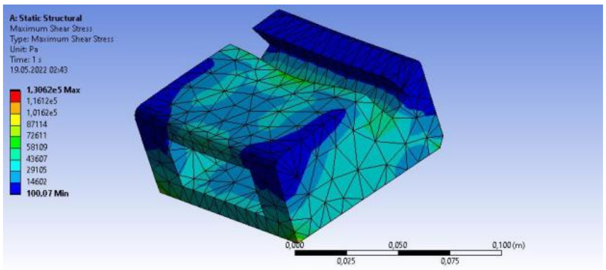

Fig. 30 Maximum shear stress

## IV. CONCLUSION

In this study, obtained the analysis results of the phone holder and powerbank unit, which designed with the solidworks 2020 program and analyzed with the Ansys 2021 program, under maximum and minimum load. Oak was chosen as the material of the phone holder and powerbank unit for Static structural Analysis. Because oak wood is a product with a stylish appearance and a strong strength value. First, 297 N was applied to the handle part of the phone holder and seen that the value of the deformation was very low despite a very large force. In second analysis, 297 N was applied to the part where the phone was placed, but 245 N was applied to the powerbank unit. As you can see in Ansys analysis reports, deformation is also very small was obtained. The weight of the telephone and powerbank units used today is quite low. The phone holder and power bank unit which is analyzed can comfortably carry the weight of the phones and powerbank used today. The phone holder with the powerbank unit designed as a model can be manufacture safely.

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