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Office Seat Design And Analysis

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Abstract – An office seat, or work chair, is a type of chair that is designed for use at a desk in an Office. Usually a padded back, a padded seat, arm that enables us to rest and the back of the chair has wheels. Office seats presently, in offices, hospitals and homes, in many places It is a product we come across. The thing that makes this product so popular compared to the chair casual/comfortable and has provided the ability to move that is. Related to working life according to the results of the review, especially for employees in small and medium-sized organizations they spend more than sitting for the sleep period. For this reason, and 19. the emergence century the reason increase employee productivity by increasing employees the time to sit office chair and study chair was named as product due. In this study two study models in standards sizes we use in our daily lives SOLIDWORKS student version of the program reviewed in the design of the seat. Also this ANSYS student version of the program in the analysis of the designs was carried out.

Keywords – *Business Efficiency, Motility, Comfort, Office Seat, Design.*

I. Introduction

An office chair is a type of seating used in workplaces or office environments. It usually has a back with sponge, a seat with sponge, an armrest and wheels that allow the chair to rotate. An office chair can have features such as height adjustment, as well as additional features such as footrest, neck support, adjustable arms, and waist-supported back. It is designed to increase productivity by allowing office workers to sit at their desks for long periods of time. This chair, which has wheels and can rotate, allows employees to continue sitting and still reach various points in the work areas, eliminating energy and time to spend standing. In one of the work seats which is designed and analyzed in this study, structural steel is used as a production agent and aluminum in the other [1-4].

The vast majority of office workers spend more than half of their working time at a desk/in front of a computer. Therefore, having a work seat that comprehensively supports the body is of great importance in preventing pains, ailments caused by long-term and incorrect sitting, such as hernia of the back and neck. Dimensional Requirements of a office seat was seen in Fig. 1 and Table 1 [1-4].

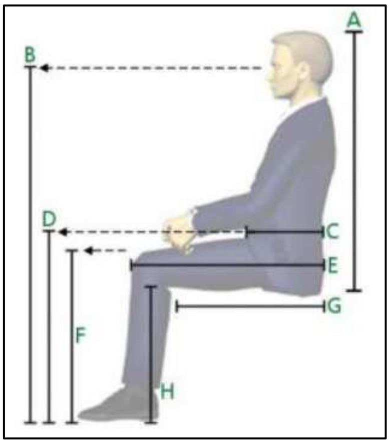

Fig. 1 Dimensional Requirements

Seat Height; One of the main features of a healthy work seat is that the seat height can be changed a little lower and up than your favorable height. Thus, the person can adjust the seat height according to the size of the body, the height of the table and the working position [1-4].

Seat Width; The work chair must have sufficient seating according to the person's body size. It should support the upper leg when seated. But it should not be so large that it touches the back of the knees and the arms cannot rest on the armrests [1-4].

Seating Depth; The depth of the working seat should be adjusted according to the leg length. In addition to comfort, the seating depth adjustment also supports maintaining posture in different working positions [1-4].

Waist Support / Back Height; A lumbar support that can be adjusted to suit the body is one of the most important features that should be found in a healthy work seat. Lumbar support supports the lumbar cavity and lower spine, reducing the pressure and load that long-term sitting will create in the waist. A work chair, where the back height can be adjusted according to body measurements, supports the back and waist in different sitting positions, reducing stress and pressure on the spine. An accurate Back height helps maintain posture, ensuring that even the position of the legs and arms is improved [1-4].

Backrest Slope; Supporting the natural slope of the spine, a back slope replaceable work chair relaxes and protects the upper body and back [1-4].

Rotational Capability; A healthy work chair should be able to rotate in such a way as to provide order to the movements, without the need to move with the whole body frequently [1-4].

Materials; Materials used in the production of a work chair that comes into contact with the body throughout the day should not contain chemicals harmful to health. The seating font of the work seat should not slide or be hard enough to prevent movement. Back upholstery should be produced from material that regulates movements in the air space and during operation [1-4].

Wheels; The feet of the working seat must be wide enough to prevent falling, even if the center of gravity changes. Wheels should be preferred according to the floor of the environment used, according to the hard floor or soft floor. It must also have lockable features when seated or lifted according to the way it works [1-4].

Armrests; Armrests with back and forth mobility, which can be adjusted in height and width free of each other, provide order to body sizes and working position. In this way, the risk of health problems that may occur in the shoulders, arms, elbows and wrists is reduced to the bottom [1-4].

Back Stiffness; The back stiffness allows you to adjust the power number of the work seat according to the weight [1-4].

Tilt Forward; It is necessary to help support the back and maintain posture, even in an upright position. It should be able to exercise active sitting and muscles even while sitting by applying a certain level of pressure [1-4].

Neck Support; A neck support, which can be adjusted in angle and height according to the structure of the neck and working position, minimizes the danger of neck discomfort by supporting the neck, especially in long-term sessions [1-4].

Mechanism; The mechanism of the work seat controls how the seat font and back move, as well as various controls (buttons, levers, etc.) helps adjust the seat to suit the person [1-4].

Table 1. Dimensional Requirements

Max Material Thichness	3”
Range of Overall Width of Seat (Not Overall Chair Dimensions)	13.9” – 18.0”
Range of Backrest from Seat Height (A)	31.3” – 38.3”
Range of Waist Depth (C)	7.3” – 11.4”
Range of Thigh Clearance (D)	21.0” – 26.8”
Range of Back-to-Knee (E)	21.3 – 26.3”
Range of Seat Depth (G)	16.9” – 21.1”
Knee Height (F)	19.8” – 28.0”
Range of Seat Height from Ground (H)	19.8” – 25.0”
Distance Between Armrests	16.5” − 19.0”
Max Height	80”
Max Width	32”

II. MATERIALS AND METHOD

It was designed work seats in two different models. It was also performed the analysis by selecting the substances used in these office seats differently from each other. One of the materials used in the study is structural steel and the other is aluminum.

For the study, it was designed a work seats in two different models and sizes made of two different items in SOLIDWORKS program, and analyzed these work chair designs and their materials in the student version of the ANSYS program.

Side and front view of office seat made of structural steel which was designed by SOLIDWORKS were seen in Fig. 2 and Fig. 3, respectively.

Fig. 2 Side View of Office Seat Made of Structural Steel

Fig. 3 Front View of Office Seat Made of Structural Steel

Side and front view of office seat made of aluminum which was designed by SOLIDWORKS were seen in Fig. 4 and Fig. 5, respectively.

Fig. 4 Side View of Office Seat Made of Aluminum

Fig. 5 Front View of Office Seat Made of Aluminum

Office seat frame and backrest of office seat feet made of structural steel which was designed by SOLIDWORKS were seen in Fig. 6 and Fig. 7, respectively.

Fig. 6 Office Seat Frame Made of Structural Steel

Fig. 7 Backrest of Office Seat Feet Made of Structural Steel

Office seat frame and backrest of office seat feet made of aluminum which was designed by SOLIDWORKS were seen in Fig. 8 and Fig. 9, respectively.

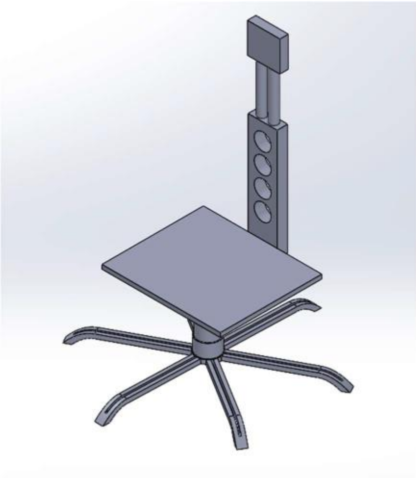

Fig. 8 Office Seat Frame Made of Aluminum

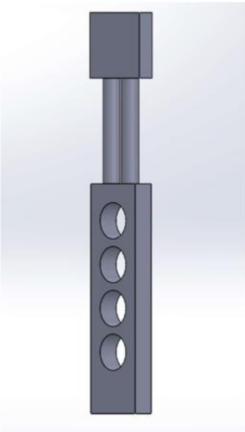

Fig. 9 Backrest of Office Seat Feet Made of Aluminum

Office seat body and office seat feet made of structural steel which was designed by SOLIDWORKS were seen in Fig. 10 and Fig. 11, respectively.

Fig. 10 Office Seat Body Made of Structural Steel

Fig. 11 Office Seat Feet Made of Structural Steel

Office seat body and office seat feet made of aluminum which was designed by SOLIDWORKS were seen in Fig. 12 and Fig. 13, respectively.

Fig. 12 Office Seat Body Made of Aluminum

Fig. 13 Office Seat Feet Made of Aluminum

III. RESULTS AND DISCUSSION

A. Analysis of Office Seat Using Aluminum

Equivalent (von-Mises) stress results of 800 N radiated force was applied to the backrest of the part and 250 N radiated force was applied to the head area were seen in Fig. 14. Maximum equivalent (von-Mises) stress was obtained as 21.886 MPa.

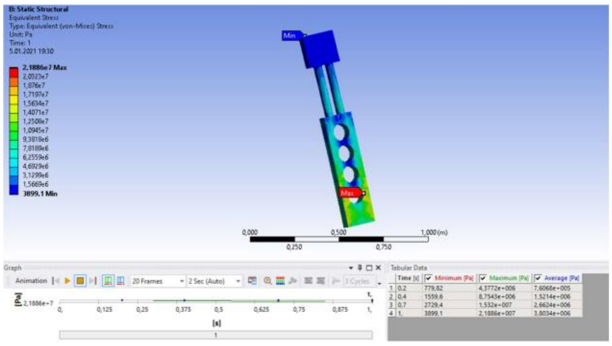

Fig. 14 Equivalent (von-Mises) Stress of Backrest of Office Seat Feet

A force of 800 N was applied to this part connecting the body and foot through the flange, which was considered constant from the base of the area where the feet were connected. Equivalent (von-Mises) stress results were seen in Fig. 15. Maximum equivalent (von-Mises) stress was obtained as 2.8447 MPa.

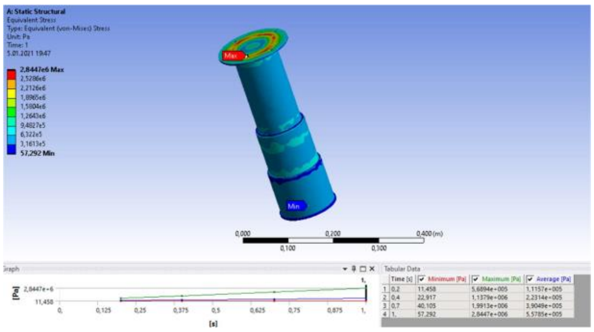

Fig. 15 Equivalent (Von-Mises) Stress of Part Connecting The Body And Foot

As in a previous analysis to measure the strength of the feet, 800 N force was applied over the flange, this time the soles of the feet were fixed and the analysis was performed. Equivalent (von-Mises) stress and total deformation results were seen in Fig. 16 and Fig. 17, respectively. Maximum equivalent (von-Mises) stress was obtained as 8.103 MPa. Maximum total deformation was obtained as 0.41374 mm. The feet should be support by feder because the part stress accretion is too much.

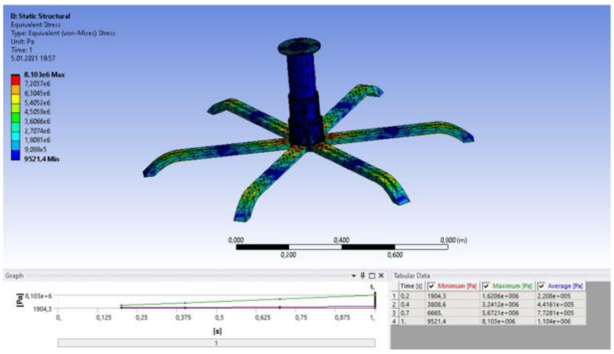

Fig. 16 Equivalent (Von-Mises) Stress of Office Seat Feet

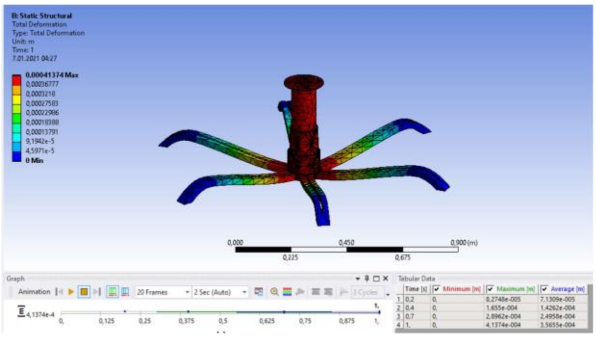

Fig. 17 Total Deformation of Office Seat Feet

The feet should be support by feder because the part stress accretion is too much. The feet were supported by 10 mm thick feder was seen in Fig. 18.

Fig. 18 The Feet Which Supported by 10 mm Thick Feder

800 N force was applied over the flange, this time the soles of the feet were fixed and the analysis was performed. Total deformation results were seen in Fig. 19. Maximum total deformation was obtained as 0.05944 mm. The same analysis was performed with the previous deformation was reduced.

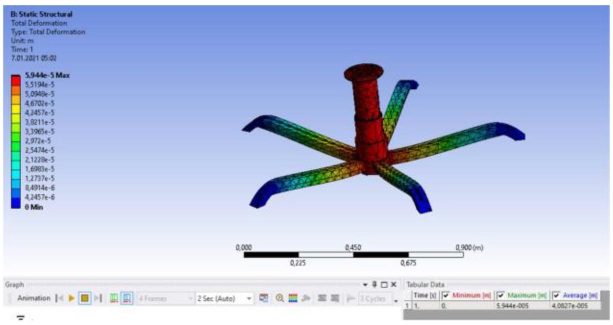

Fig. 19 Total Deformation of Office Seat Feet

All model inspection was applied to the head area as 500 N, to the back area as 1000 N and to the seating surface as 1500 N. Equivalent (von-Mises) stress results were seen in Fig. 20. Maximum equivalent (von-Mises) stress was obtained as 43.296 MPa.

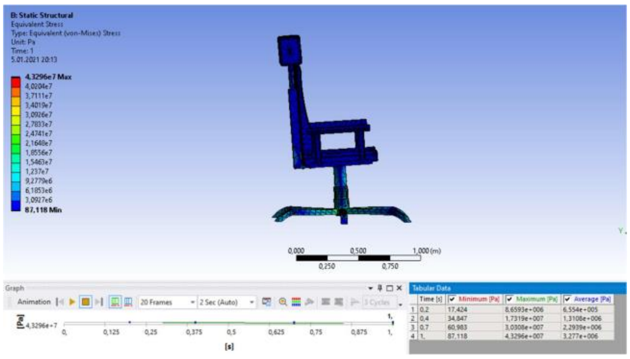

Fig. 20 Equivalent (Von-Mises) Stress of Office Seat

All model inspection was applied to the head area as 1000 N, to the back area as 1500 N and to the seating surface as 2000 N. Equivalent (von-Mises) stress results were seen in Fig. 21. Maximum equivalent (von-Mises) stress was obtained as 73.389 MPa.

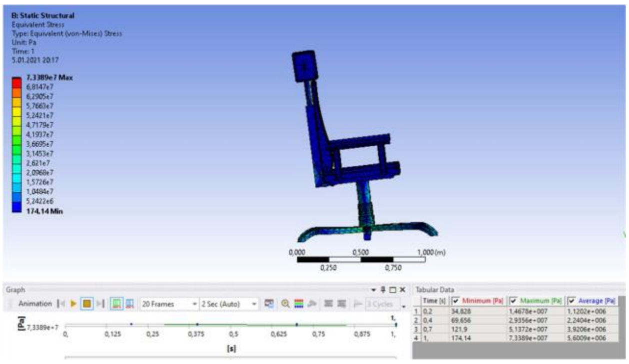

Fig. 21 Equivalent (Von-Mises) Stress of Office Seat

Feet and strength-enhancing part final assembly of the reconstructed seat was seen in Fig. 22.

Fig. 22 Final Assembly of The Reconstructed Seat

800 N force applied to the seat. Equivalent (von-Mises) stress results were seen in Fig. 23. Maximum equivalent (von-Mises) stress was obtained as 10.245 MPa.

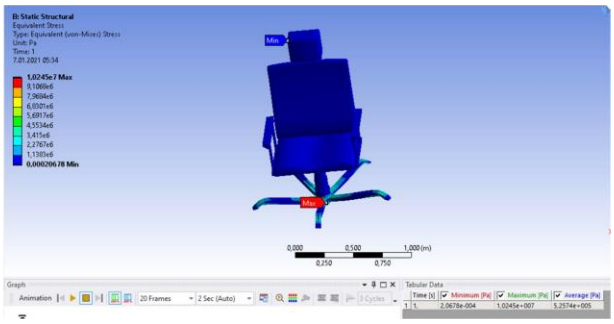

Fig. 23 Equivalent (Von-Mises) Stress of Office Seat

B. Analysis of Office Seat Using Structural Steel

When it was put together this work chair design as an assembly, it was able to examine it in more detail.

A radiated force of 800 N was applied to the flange element, which allowed it to be connected to the body. Equivalent (von-Mises) stress and total deformation results were seen in Fig. 24 and Fig. 25, respectively. Maximum equivalent (von-Mises) stress was obtained as 2.5095 MPa. Maximum total deformation was obtained as 0.14055 mm. And the deformed element was re-examined because the deformation of the part was excessive.

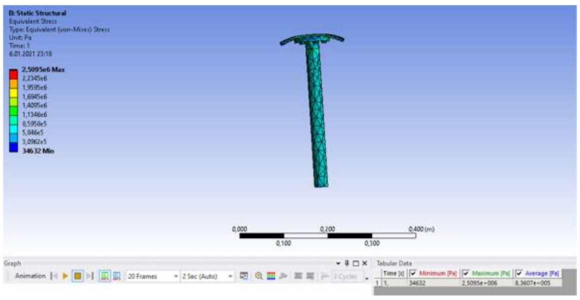

Fig. 24 Equivalent (Von-Mises) Stress of Office Seat Body

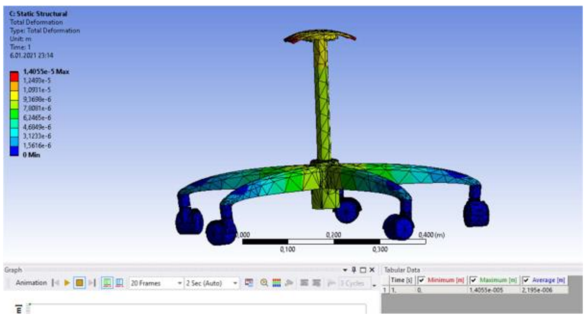

Fig. 25 Total Deformation of Office Seat Body

A wheel analysis was performed by fixing the base of the wheel, and stresses were tested by applying a force of 200 N from the pin zone that allows it to be attached to the foot. Equivalent (von-Mises) stress results were seen in Fig. 26. Maximum equivalent (von-Mises) stress was obtained as 12.012 MPa.

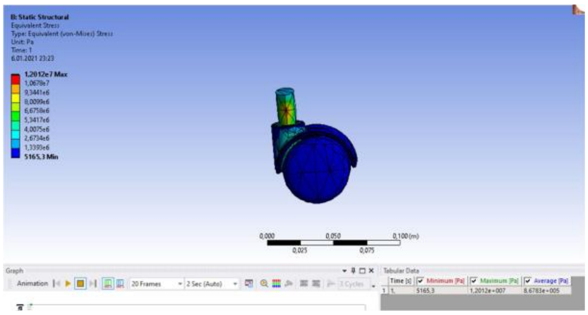

Fig. 26 Equivalent (Von-Mises) Stress of Wheel

800 N force was applied to the seating surface of the seat. Fixed from the wheels. Equivalent (von-Mises) stress results were seen in Fig. 27. Maximum equivalent (von-Mises) stress was obtained as 7.1768 MPa.

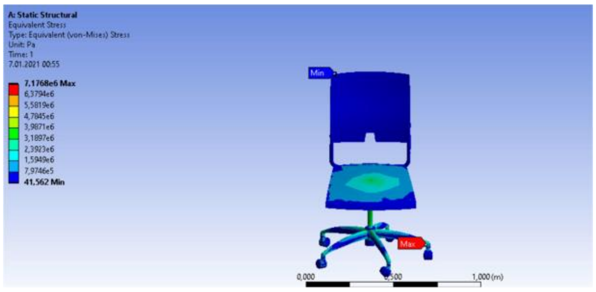

Fig. 27 Equivalent (Von-Mises) Stress of Office Seat

IV. CONCLUSION

It was analyzed two chair models that designed using SOLIDWORKS using the student version of the ANSYS program.

Designed both models have stress accretions on the feet. In the model which was created using aluminum, it was made “Radius" to the joints in the foot and neck, but because the amount of pressure was surprisingly high, “Feder” was used to combine and support the foot and neck part. When compared these designs under constant conditions, they were 7 times less deformed than the previous ones.

Another design, model building and steel seat that we encounter in our daily lives we often are designed using a common design, but designed in a more subtle way instead of sitting that allows you to connect to 0,14 mm flange deformation. It was observed the influence of constant forces due to the domed structure of the feet of the work seat and the fact that it was formed the feet with walls during the design phase, the stress distribution on the feet of seat design is more homogeneous, as well as this applies to deformations. But the intensity of stress at the junction between the foot and neck is very high, as in the previous model.

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