Final Project Presentation
on
Design ,Analysis and Fabrication of Nu-bike

Objective

- Main objective of this project is to reduce the components used and cost of traditional bicycle without compromising the efficiency.
- To reduce the maintenance cost of bicycle.
- Designing and analysis of the system on solid works.

Project modules

- **Module 1:** Project designing and calculation.
- **Module 2:** Component selection and purchasing.
- **Module 3:** Fabrication or assembling.
- **Module 4:** Testing and documentation.

Progress in Work:

- Module 1,2 ,3 & 4 comprises of 100% of project is completed.

Component Used

1- Wheel

2- Saddle

3- Handlebars

4- Seat post

5- Frames

6 – Brake lever

7- Leverage paddles

Selection of Materials

Based on the advantages discussed earlier, the E-Glass/Epoxy, High Strength Carbon/Epoxy and High Modulus Carbon/Epoxy materials are selected for composite Drive link. The Table shows the properties of the E-Glass/Epoxy, High Strength Carbon/Epoxy and High Modulus Carbon/Epoxy materials used for composite Drive links.

Application requirements

APPLICATION	FUNCTION	WEAR	STRENGTH
WHEEL	Multi part mechanical performance	Tensile loading	Tensile strength
FRAME	Core structure	Stress/strain loading	Tension/compression strength
COMPONENTs	Moving mechanical parts	High mechanical wear	Need varies

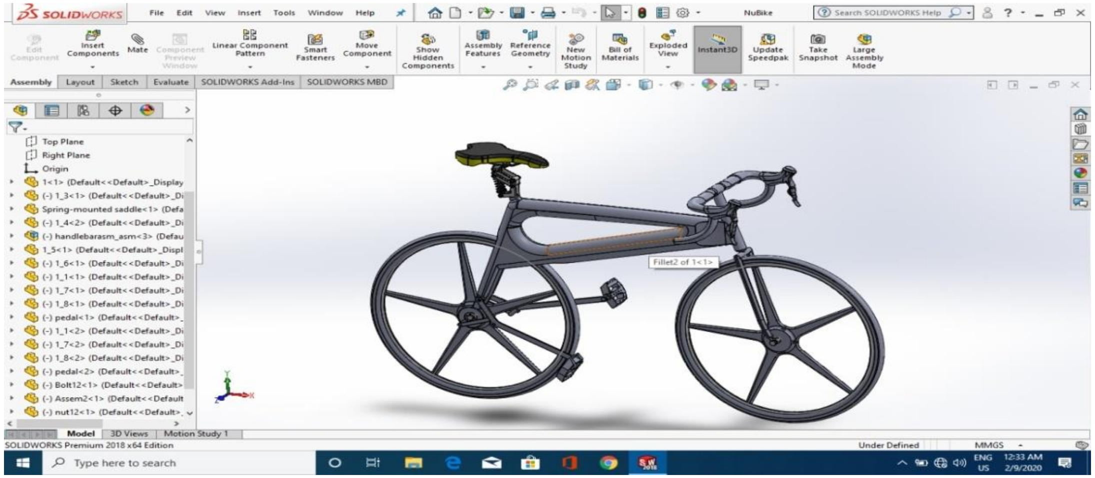
Design and Features

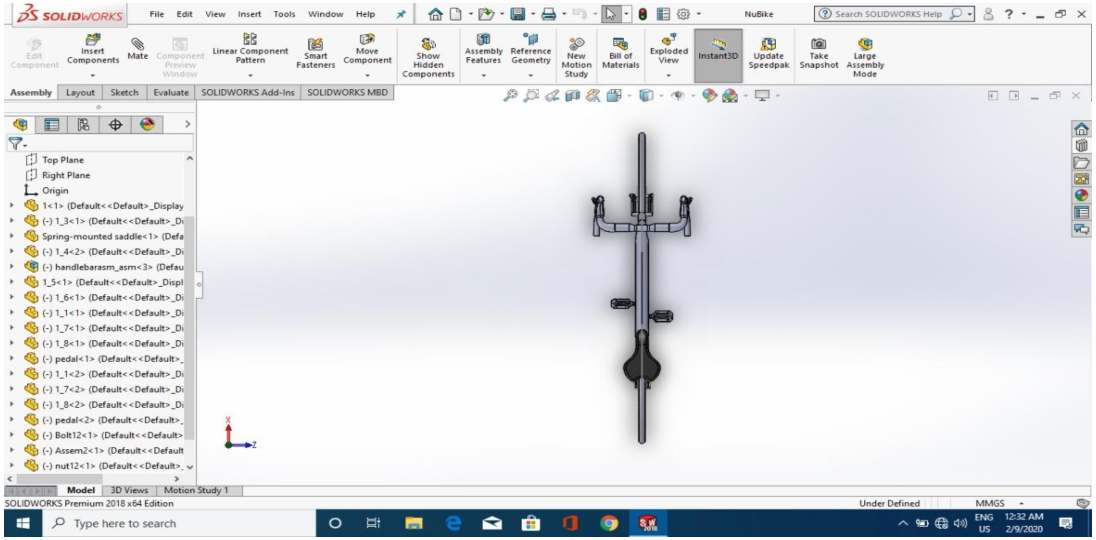
In the absence of the regular chain, Nu Bike features lengthened pedal cranks in order to provide more leverage and power.

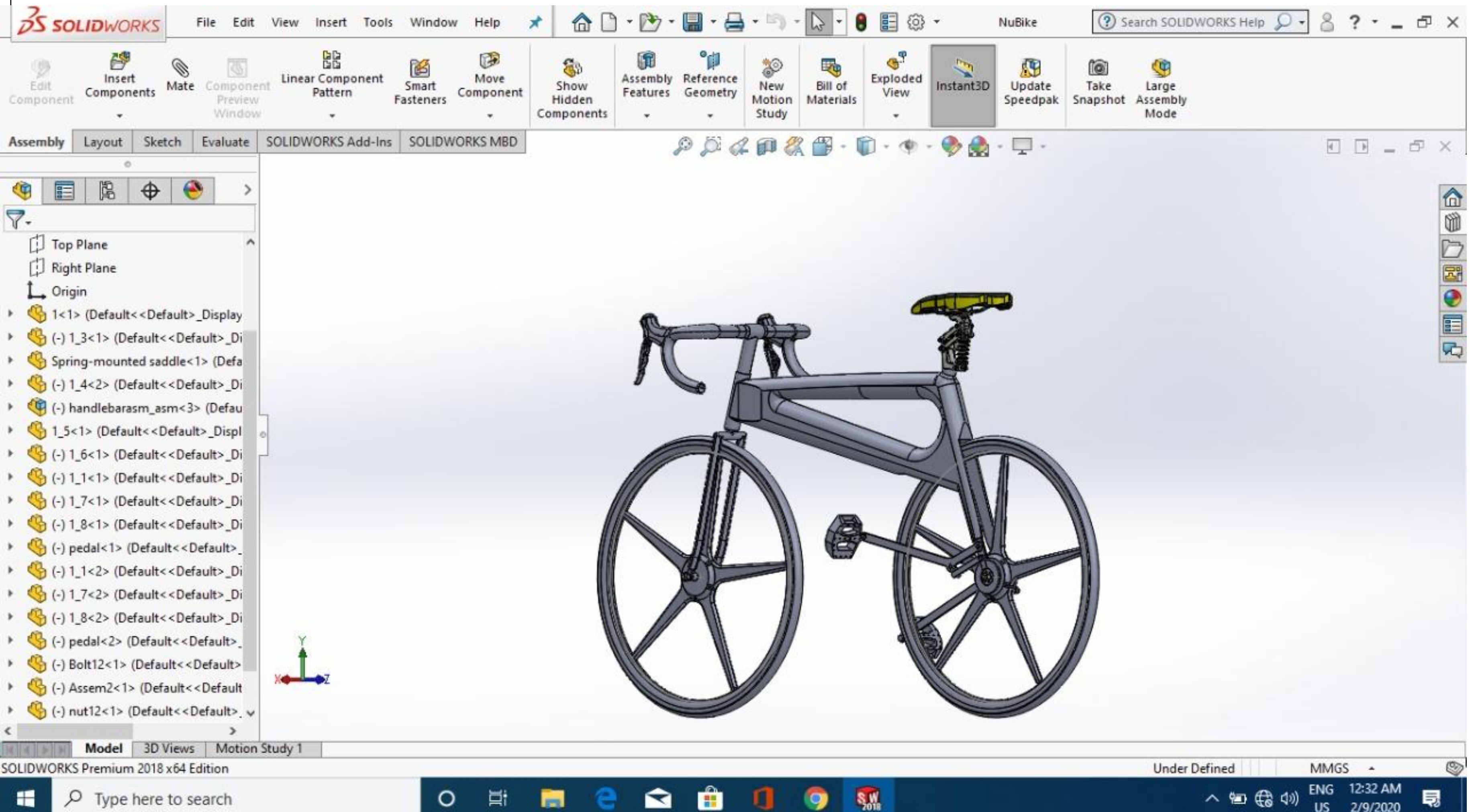
The leverage advantage gives riders the freedom to cover longer distances while expending comparatively less effort.

The increase in power, on the other hand, means Nu Bike would need fewer gears than regular bikes.

DESIGN OF NU BIKE



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BASIC FORMULA USED FOR CALCULATIONS

1. Mechanical advantage = RESISTANCE FORCE/APPLIED FORCE

2. Arc Angle = Arc length ×360°/2π× RADIUS

3. Helical Torsional Spring

   Bending stress =(32 × T) /(π × d^3)

   where, T is torque acting on a spring and d is diameter of the spring wire

   Number of coils, n = (α × E ×d^4)/(64×T×D)

   where, α is the angle of twist and E is the modulus of elasticity.

Design Calculation

- Inner Diameter of link (di) = 0.026 m
- Outer Diameter of link (do) = 0.028 m
- Length of link (L) = 0.335 m
- Number of teeth = 16

* Link Pitch (P) = MT/2

On it and so the maximum torque will "Tmax",

Tmax = {body mass of the rider x g} x the length of the pedal lever

□0.008*16/2 = 0.128/2 = 0.064 m

- Module (m) = 0.008 m

- Mass Moment of Inertia (I) = $MR^2/2$

=4*0.0142 = 0.0039

- Polar Moment of Inertia (J) = $\pi (do^4 - di^4)/32$

□π (0.0284 – 0.0264)/32 = $(4.953X10^{-7})/32$

□$1.548 X 10^{-8}$

- Maximum Torque on bicycle is given by T = (Mass of rider x g) L

Where, L = Length of pedal crank in m

□g = 9.81 m/sec^2 (Assume mass of rider = 60 kegs) T = 60 x 9.81 x 0.335 = 197.2 Nm

- Power (P) = $2\pi NT/60 = (2\pi \times 110 \times 197.2) / 60$ = 2271.5 watts
- Shear Stress ( ) = $T\rho/J$ = (197.2)(7209) /$1.548 X 10^{-8}$ = $9.18 X 10^{13}$ N/m^4
- Maximum Shear Stress (max) = TRo/J = (197.2)(0.014) / ($1.548 x 10^{-8}$)

=$17.83 X 10^7$

- Bending moment (M) = / Where, E = Young's modulus

I = Moment of Inertia R = Radius (Ro)

M = (105 X 0.0039)/ 0.014 = 29.25

- Ө = TL /GJ = (197.2)(0.335)/(36.75)($1.548 X 10^{-8}$)

‶66.06/($5.68X10^{-7}$) = $1.163X10^9$

*Torsion is the twisting of an object due to an applied torque. It is expressed in Newton meters (N-m), in sections perpendicular to the torque axis, the resultant shear stress in this section is perpendicular to the radius. For links of uniform cross-section the torsion is:

Where,

•*T* is the applied torque Nm.
•is the maximum shear stress at the outer surface o *r* is the distance between the rotational axis = =
O ℓ is the length of the object the torque is being applied to or over.
•*Θ is* the angle of twist in radians.
O *G* is the shear modulus or more commonly the modulus of rigidity (GPa),
•*r*outer radius
•Torsion (T) = / = (1.548 X 10^{-8})(36.75)(1.163 X 10^{9}) / 0.335 Torsion (T) = 1974.9 Nm

Stress-Strain Relationship-

The Drive link with two links experience two kinds of stresses, bending stress and shear stress. The maximum bending stress generated at the outer most fiber of the link. And on the other hand, the shear stress is generated at the inner most fiber. Also, the value of maximum bending stress is much more than the shear stress. So, the design of the link will be based on the maximum bending stress and will be driven by the following formula:

Maximum bending stress $\mathbf{T_b = (M * r) / I}$

Where,

M is maximum bending moment on the link.

r is the radius of the link.

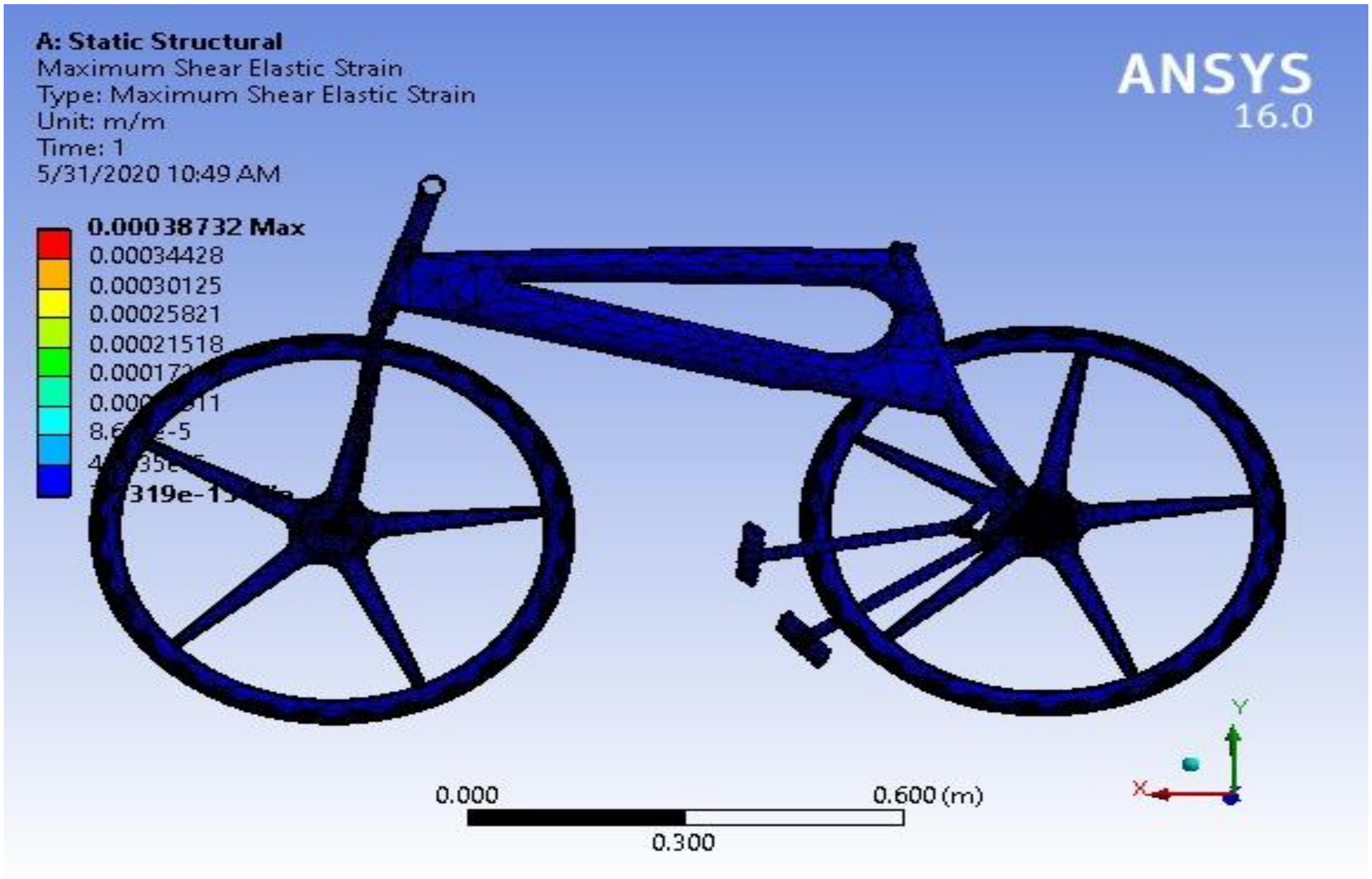
I is area moment of inertia of the link.

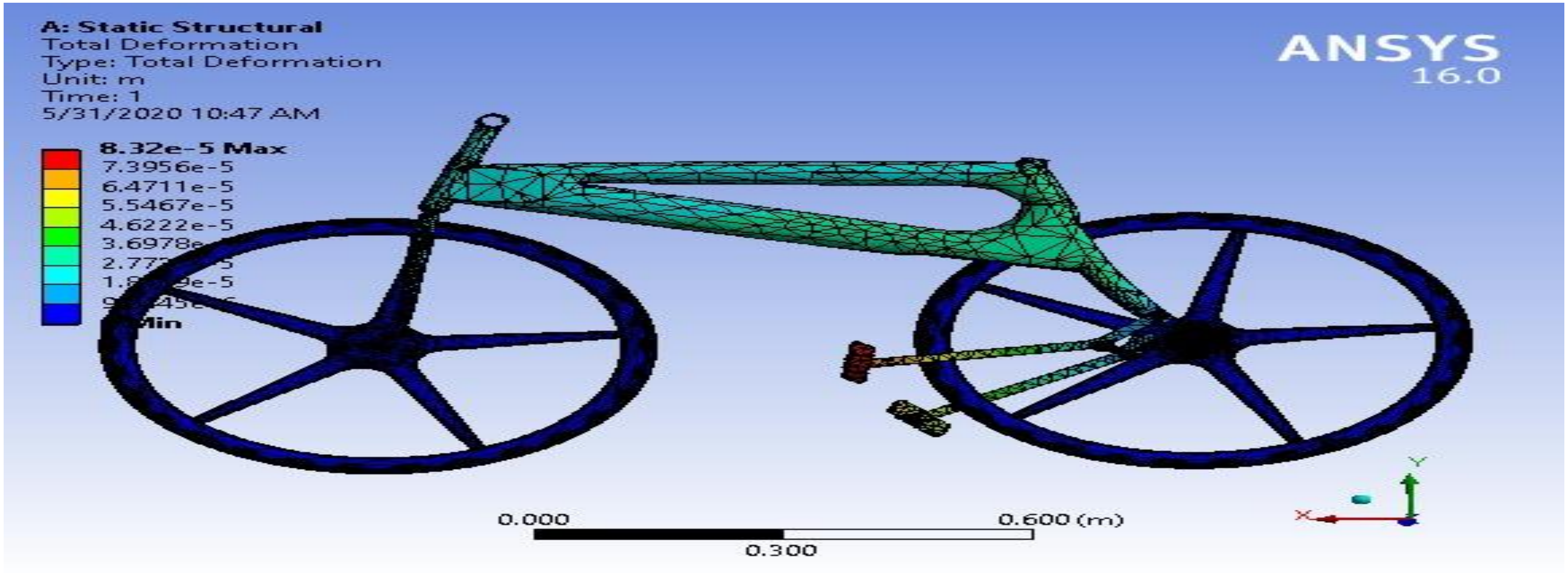
Design Optimization

1. Optimization of an engineering design is an improvement of a proposed design that results in the best properties for minimum cost. Most of the methods used for design optimization assume that the design variables are continuous. In structural optimization, almost all design variables are discrete.

2. Low weight of body is desirable, which can be done by good designing, ensuring quality check, using material such as F.R.P, aluminum, composite materials and low density metals. A very good alternative is F.R.P which is strong, none conducting, cheap, light weight, highly durable, resistant to fire, withstands weather and is easily repaired in case of damage. The body is attached to camera and motor by the means of bolts, in some cases the rods are welded. The body should be built to keep in mind quality and design which is light in weight, and ensures child safety.

Analysis of NuBike

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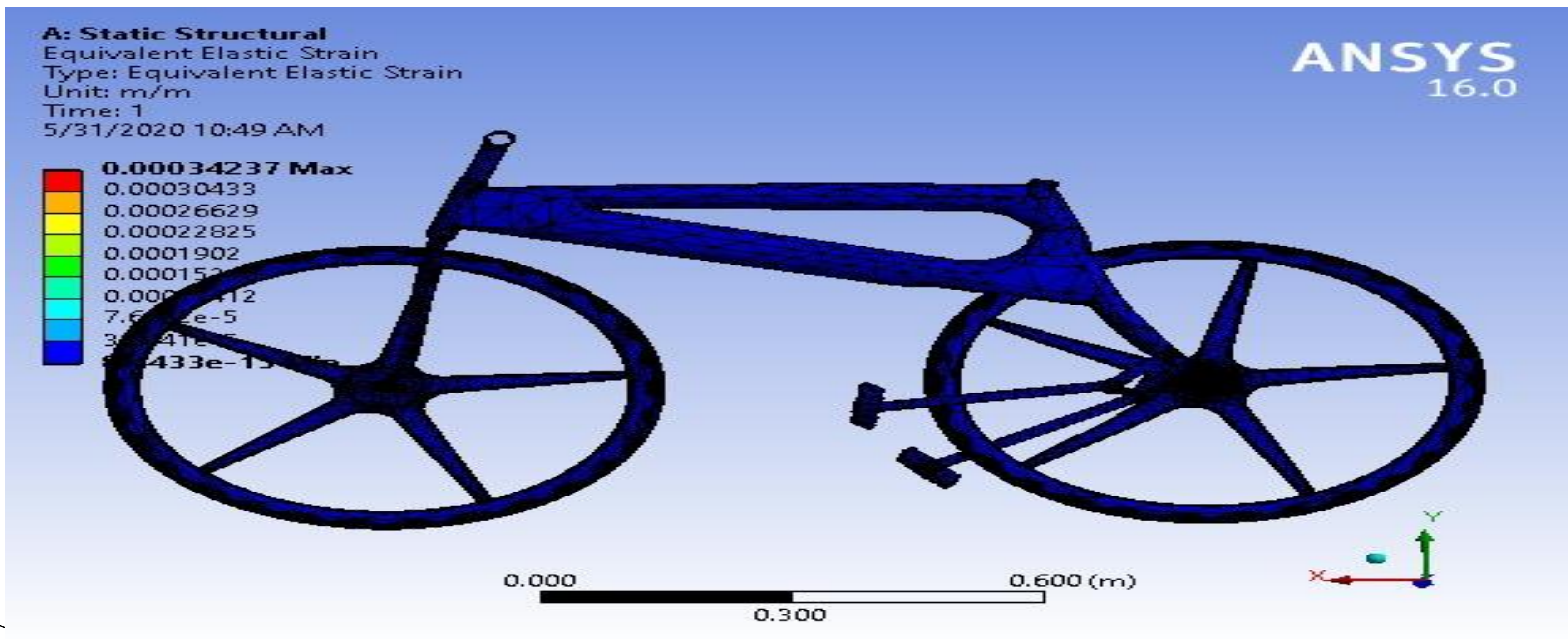
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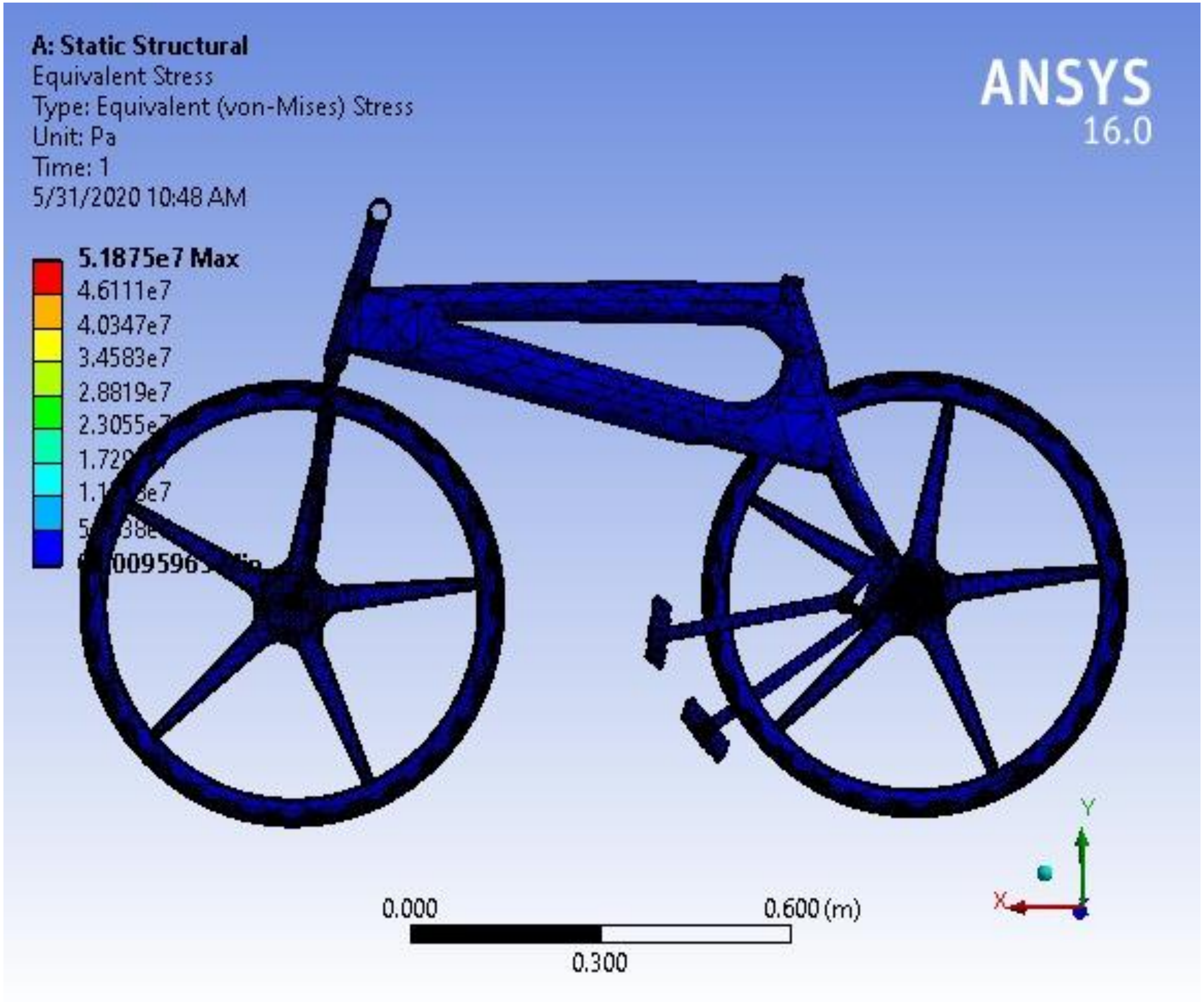
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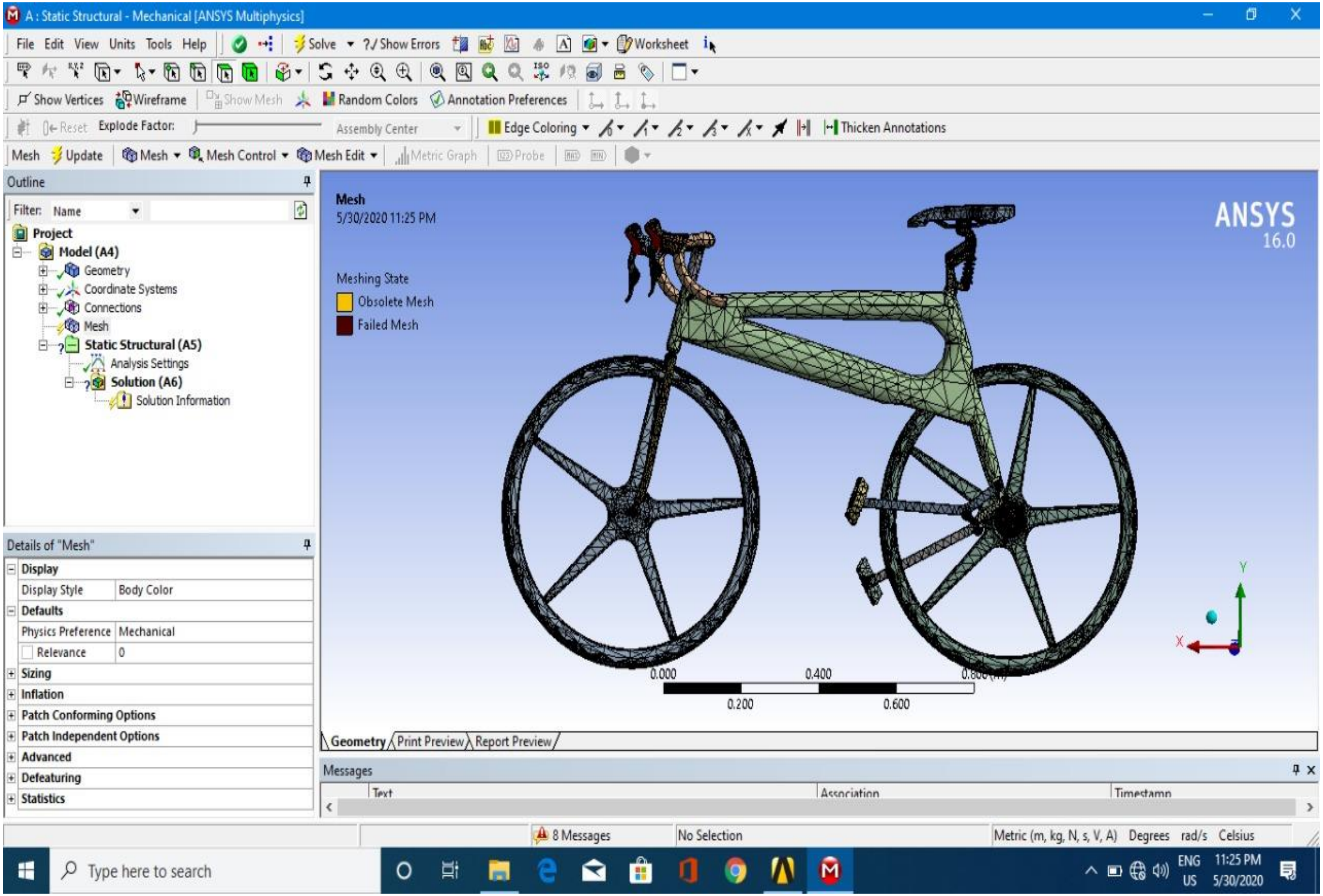
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Fabrication of NuBIKE

Advantages

- Drive system is less likely to become jammed, a common problem with chain-driven bicycles.
- The rider cannot become dirtied from chain grease or injured by the chain from "Chain bite", which occurs when clothing or even a body part catches between the chain and a sprocket.
- Lower maintenance than a chain system when the Drive link is enclosed in a tube.
- Dynamic Bicycles claims that a Drive link bicycle can deliver 94% efficiency, whereas a chain-driven bicycle can deliver anywhere from 75-97% efficiency based on condition.
- Greater clearance: with the absence of a derailleur or other low-hanging machinery, the bicycle has nearly twice the ground clearance.

Result and Conclusion

- The presented work also deals with design optimization i.e. converting rotary motion in linear motion with aid of two Pedal links.
- Instead of chain drive one piece Drive link for wheel drive bicycle have been optimally designed and manufactured for easily power transmission.
- ·The drive link with the objective of minimization of weight of link which was
- subjected to the constraints such as torque transmission , torsion buckling capacity ,

stress, strain , etc

- The torque transmission capacity of the bicycle Drive link has been calculated by neglecting and considering the effect of centrifugal forces and it has been observed that centrifugal force will reduce the torque transmission capacity of the link.
- The stress distribution and the maximum deformation in the Drive link are the functions of the stacking of material. The optimum stacking of material layers can be
- used as the effective tool to reduce weight and stress acting on the Drive link.

References

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- Anup A. Bijagare, P.G. Mehar and V.N. Mujbaile "Design Optimization & Analysis of Drive link", Vol. 2 (6), 2012, 210-215.


THANK
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