***Evaluation of truss design alternatives***

In evaluating the design alternatives, we consider only the design components that only have effect the in the horizontal plane. To support horizontal force, we considered the following three truss designs:

***Truss #1***

Length: 1.063m

# of members: 7

Weight:71.5g

Max Deflection: -6.322e-005

Efficiency: 1106138.4

Truss #1 is based on the first truss design found in Lab #1. This is the truss we decided to choose for our design. The criteria by which we made this decision is:

1. **Overall simplicity** – We planned on using jigs for constructing our truss and therefore the design with the fewest members made for the easiest construction and minimized the possibility of making mistakes.
2. **Sufficiency** - We surmised, from our previous calculations made in Lab#1, that this design would be sufficient to hold up under the horizontal force produced by motor acceleration.
3. **Efficiency** - It was the best choice designs in terms of efficiency.
4. **Overall Length** – This design had an overall length that was relatively small, which allowed us the freedom to build our truss without concern for running out of material.

***Trusses #2 & #3***

The following designs were considered initially, but later rejected upon further consideration:

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| --- | --- |
| ***Truss #2***  Length: 1.675m  # of members: 14  Weight: 112.5g  Max Deflection: -5.814e-005  Efficiency: 764438.3 | **Truss #3**  Length: 1.709m  # of members: 16  Weight: 114.9g  Max Deflection: -1.071e-004  Efficiency: 406312.8 |

1. **Overall simplicity** – Both these designs have twice as many members and more nodes than the first choice making them more difficult to construct and increased the possibility of mistakes during cutting/grinding/soldering.
2. **Efficiency** – Truss #2 and Truss # 3 are 31% and 63% less efficient than Truss #1, respectively, which made them significantly less desirable as a design choice.
3. **Overall Length** – These designs had an overall length that was around .7m longer than the truss design we choose, which would have left us with much less room for error during construction.

|  |  |
| --- | --- |
| **Truss #1**  Length: 1.063m  Weight:71.5g  Max Deflection: -6.322e-005  Efficiency: 1106138.4 | **\*\*\*\*Nodal Displacement Result\*\*\*\*\*\***  **Node Ux Uy Angle of Bending**  **1 1.900e-029 3.443e-013 0.000e+000**  **2 3.233e-006 -8.907e-007 0.000e+000**  **3 1.690e-022 -6.322e-005 0.000e+000**  **4 2.764e-029 -8.907e-014 0.000e+000**  **5 -3.233e-006 -8.907e-007 0.000e+000**  **\*\*\*\*Nodal Reaction Result\*\*\*\*\*\***  **Node Fx Fy Moment**  **1 -4.441e-015 -2.381e+001 0.000e+000**  **2 3.553e-015 2.087e-015 0.000e+000**  **3 5.551e-017 8.882e-016 0.000e+000**  **4 -4.281e-016 2.881e+001 0.000e+000**  **5 -4.441e-016 -3.553e-015 0.000e+000** |
| **Truss #2**  Length: 1.675m  Weight: 112.5g  Max Deflection: -5.814e-005  Efficiency: 764438.3 | **\*\*\*\*Nodal Displacement Result\*\*\*\*\*\***  **Node Ux Uy Angle of Bending**  **1 -1.562e-028 2.887e-013 0.000e+000**  **2 3.758e-006 -1.111e-006 0.000e+000**  **3 -2.446e-006 -4.283e-005 0.000e+000**  **4 -1.682e-007 -1.076e-013 0.000e+000**  **5 -3.586e-006 -9.276e-007 0.000e+000**  **6 -7.785e-006 -4.292e-005 0.000e+000**  **7 4.636e-006 -4.293e-005 0.000e+000**  **8 -1.924e-006 -5.814e-005 0.000e+000**  **\*\*\*\*Nodal Reaction Result\*\*\*\*\*\***  **Node Fx Fy Moment**  **1 2.309e-014 -3.000e+001 0.000e+000**  **2 -1.066e-014 9.033e-015 0.000e+000**  **3 7.105e-015 2.274e-013 0.000e+000**  **4 -7.105e-015 3.500e+001 0.000e+000**  **5 0.000e+000 7.105e-015 0.000e+000**  **6 0.000e+000 -7.105e-014 0.000e+000**  **7 0.000e+000 7.105e-014 0.000e+000**  **8 -1.421e-014 0.000e+000 0.000e+000** |
| **Truss #3**  Length: 1.709m  Weight: 114.9g  Max Deflection: -1.071e-004  Efficiency: 406312.8 | **\*\*\*\*Nodal Displacement Result\*\*\*\*\*\***  **Node Ux Uy Angle of Bending**  **1 -1.172e-028 2.887e-013 0.000e+000**  **2 3.586e-006 -9.276e-007 0.000e+000**  **3 6.160e-006 -9.116e-005 0.000e+000**  **4 1.176e-005 -1.042e-013 0.000e+000**  **5 -3.876e-006 -1.237e-006 0.000e+000**  **6 -5.276e-006 -9.069e-005 0.000e+000**  **7 7.785e-006 -9.162e-005 0.000e+000**  **8 3.361e-006 -1.071e-004 0.000e+000**  **9 1.456e-005 -4.448e-005 0.000e+000**  **10 3.038e-005 -3.962e-005 0.000e+000**  **\*\*\*\*Nodal Reaction Result\*\*\*\*\*\***  **Node Fx Fy Moment**  **1 1.155e-014 -3.000e+001 0.000e+000**  **2 7.105e-015 2.717e-015 0.000e+000**  **3 1.421e-014 -9.166e-013 0.000e+000**  **4 -5.684e-014 3.500e+001 0.000e+000**  **5 -1.421e-014 7.105e-015 0.000e+000**  **6 -1.421e-014 3.979e-013 0.000e+000**  **7 0.000e+000 1.705e-013 0.000e+000**  **8 2.132e-014 -5.684e-014 0.000e+000**  **9 -5.684e-014 -1.421e-014 0.000e+000**  **10 0.000e+000 1.421e-014 0.000e+000** |