Second Generation Bicycle Charging Station Engineering Analysis

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Overview

- **Design Assumptions**
- **Gearing**
  - **Load Analysis - rpm**
- **Structural Analysis**
  - **Frame**
  - **Stand**
- **Project Update**
- **Conclusion**

Kori Molever

Design Assumptions

- **Crank length has negligible effect on maximum power production**
- **Neglect load on bearings**
- **Axles and front fork are sufficiently strong**

Gearing

- **Single Speed Bicycle**
  - **Simple design**
  - **Low cost**
  - **Discomfort at high speeds**

Gearing

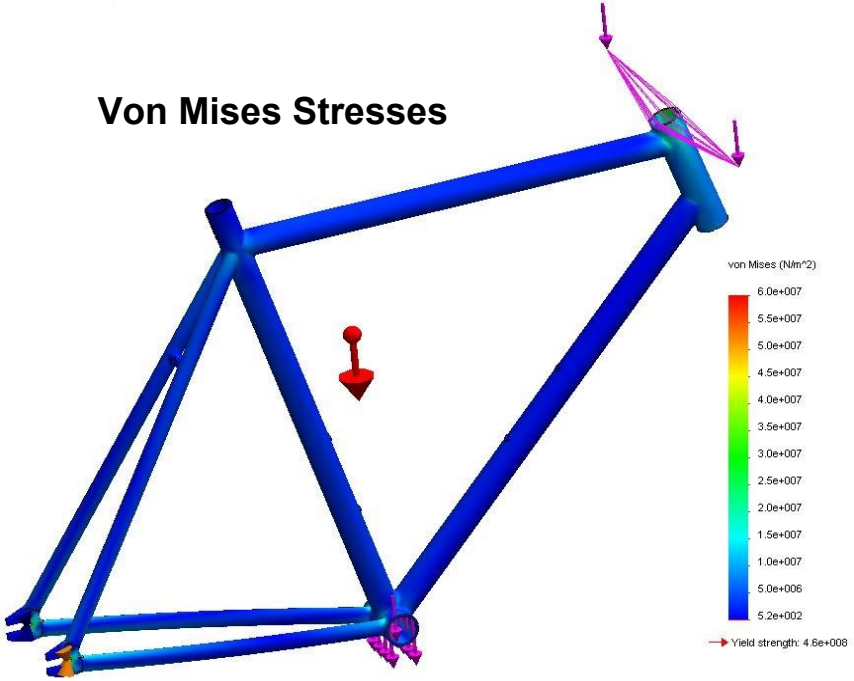
- **Geared Bicycle**
  - **More expensive**
  - **Maintain high RPM comfortably**

RPM Analysis

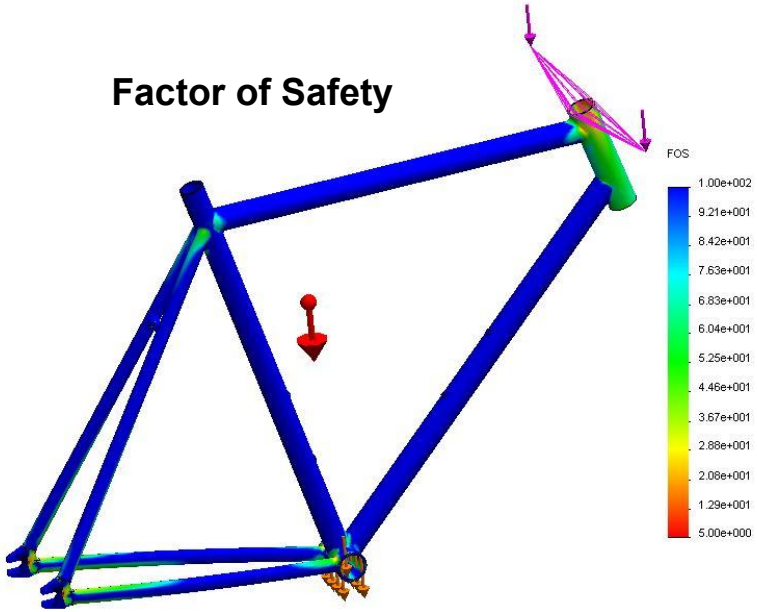
	User Input (RPM) [Average]	Front Gear (teeth)	Rear Gears (teeth)	Rear Tire Diameter (in.)	Generator Track Diameter (in.)	Expected Range (RPM) [Average]
Single Speed	**40-132 [71]**	**42**	**17**	**26.6**	**3**	**876-2891 [1555]**
3-Gear	**40-132 [68]**	**42**	**16-32**	**26.6**	**3**	**1536-3072 [1653]**

Single Speed Frame Analysis

Von Mises Stresses



Factor of Safety



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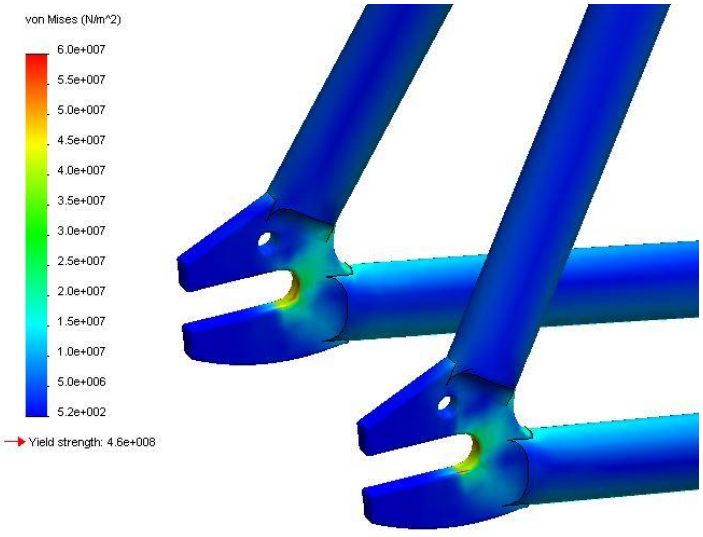
Single Speed Frame Analysis

Von Mises Stresses



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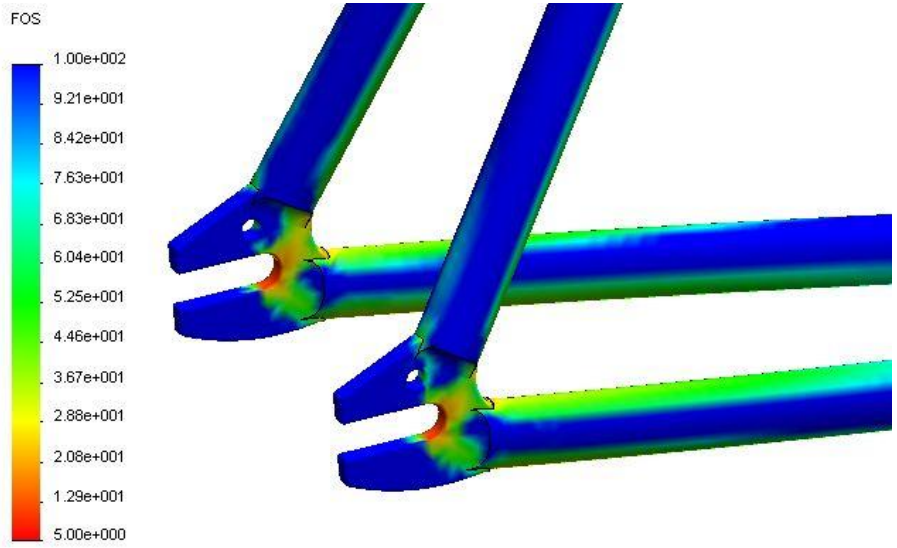
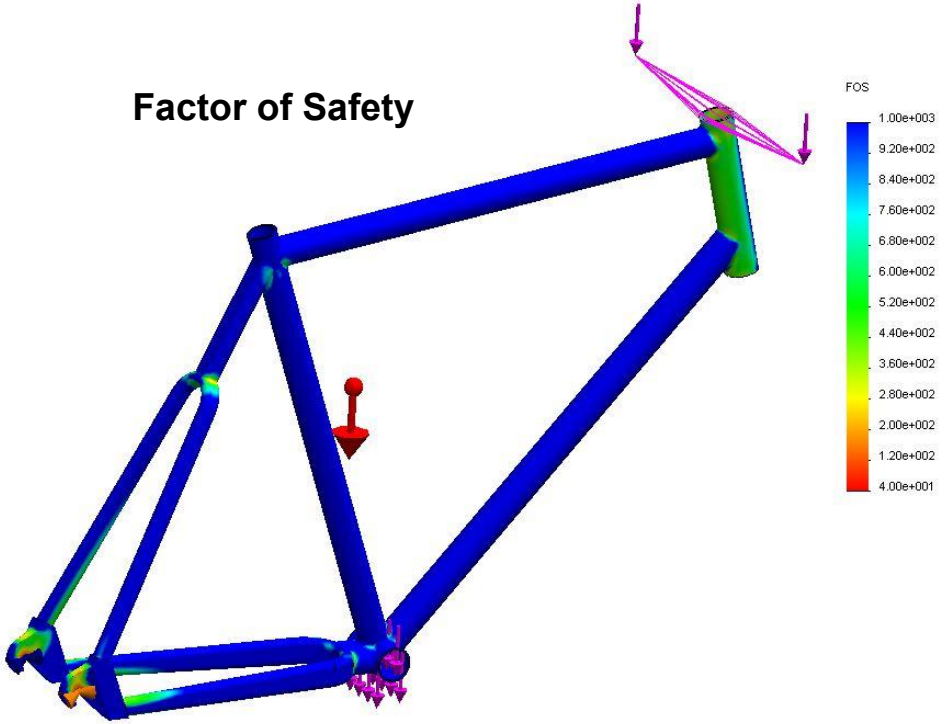


Geared Frame Analysis

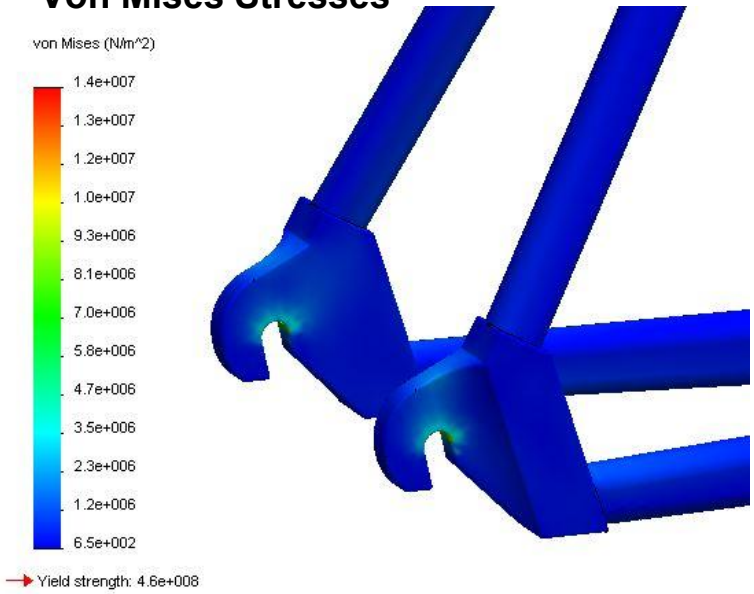
Von Mises Stresses

Factor of Safety



Geared Frame Dropouts

Von Mises Stresses



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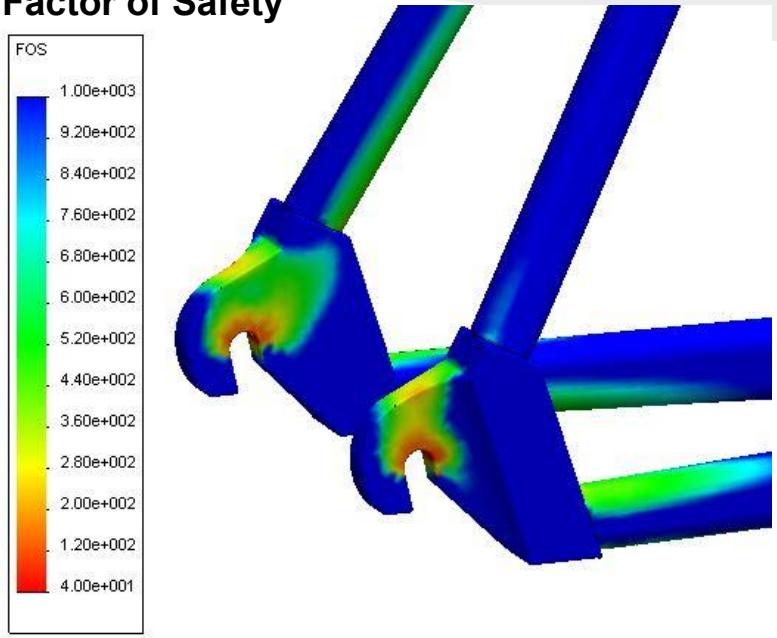
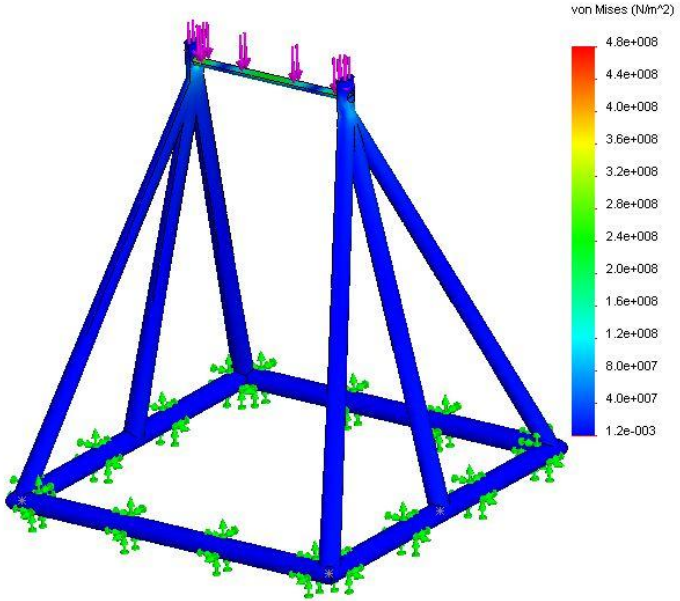


Stand Analysis

Von Mises Stresses



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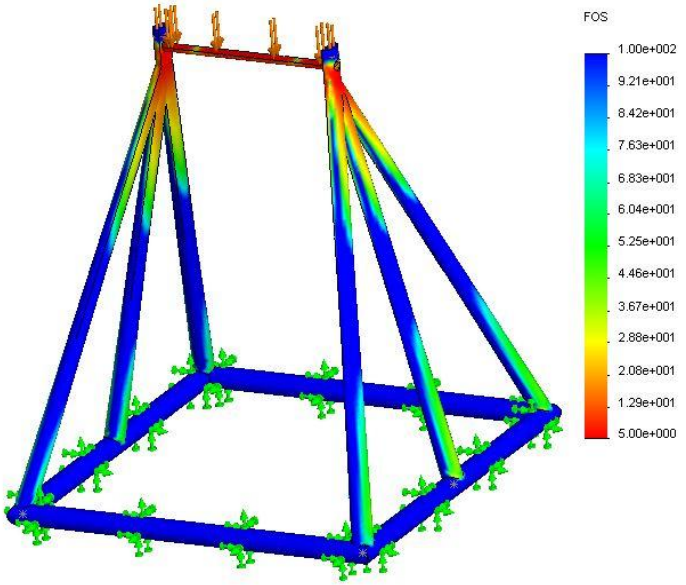
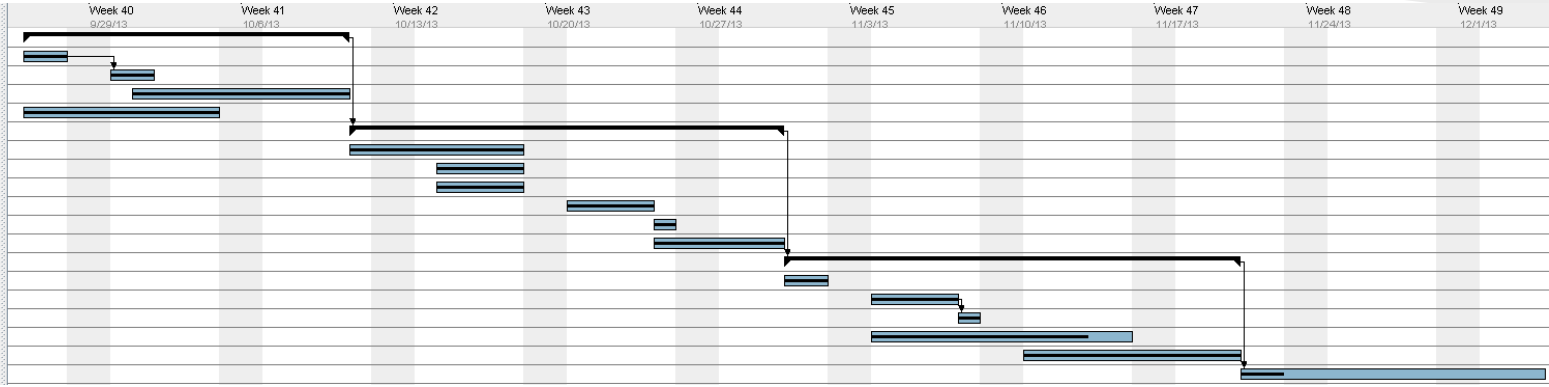


Connor Kroneberger

Project Updates

Name	Begin d..	End date
Project Needs, Specifications, Plan	9/26/13	10/10/13
Project Needs Generation	9/26/13	9/27/13
Objectives/Specification Gener...	9/30/13	10/1/13
QFD Analysis	10/1/13	10/10/13
Semester Project Timelin Plan...	9/26/13	10/4/13
Concept Generation and Selection	10/11/13	10/30/13
Gearing Concept Generation	10/11/13	10/18/13
Adjustability Concept Generation	10/15/13	10/18/13
Power Storage Concept Gener...	10/15/13	10/18/13
Portability Concept Generation	10/21/13	10/24/13
Update QFD/Decision Matrix	10/25/13	10/25/13
Concept Selection	10/25/13	10/30/13
Engineering Analysis	10/31/13	11/20/13
Preliminary Analysis Meetings	10/31/13	11/1/13
Portability Design	11/4/13	11/7/13
Portability Analysis	11/8/13	11/8/13
Power/Gear Analysis	11/4/13	11/15/13
Adjustability Analysis	11/11/13	11/20/13
Project Proposal	11/21/13	12/4/13



Kori Molever

Conclusion

- **Geared Frame found to be structurally superior to single-speed frame.**
- **FEA analysis of stand with 1200 N distributed load has minimum FOS value of 5.**
- **Geared configuration nominal output to generator is ~1653 rpm**

References

[1] Budynas, R.G., Nisbett, J.K., “Shigley’s Mechanical Engineering Design” 9th Edition. McGraw Hill, New York, NY. 2011

[2] Whitt, F.R., Wilson, D.G., “Bicycling Science” 2nd edition. MIT Press, Cambridge, MA. 1982

Questions?