
Spring 2022

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Authors

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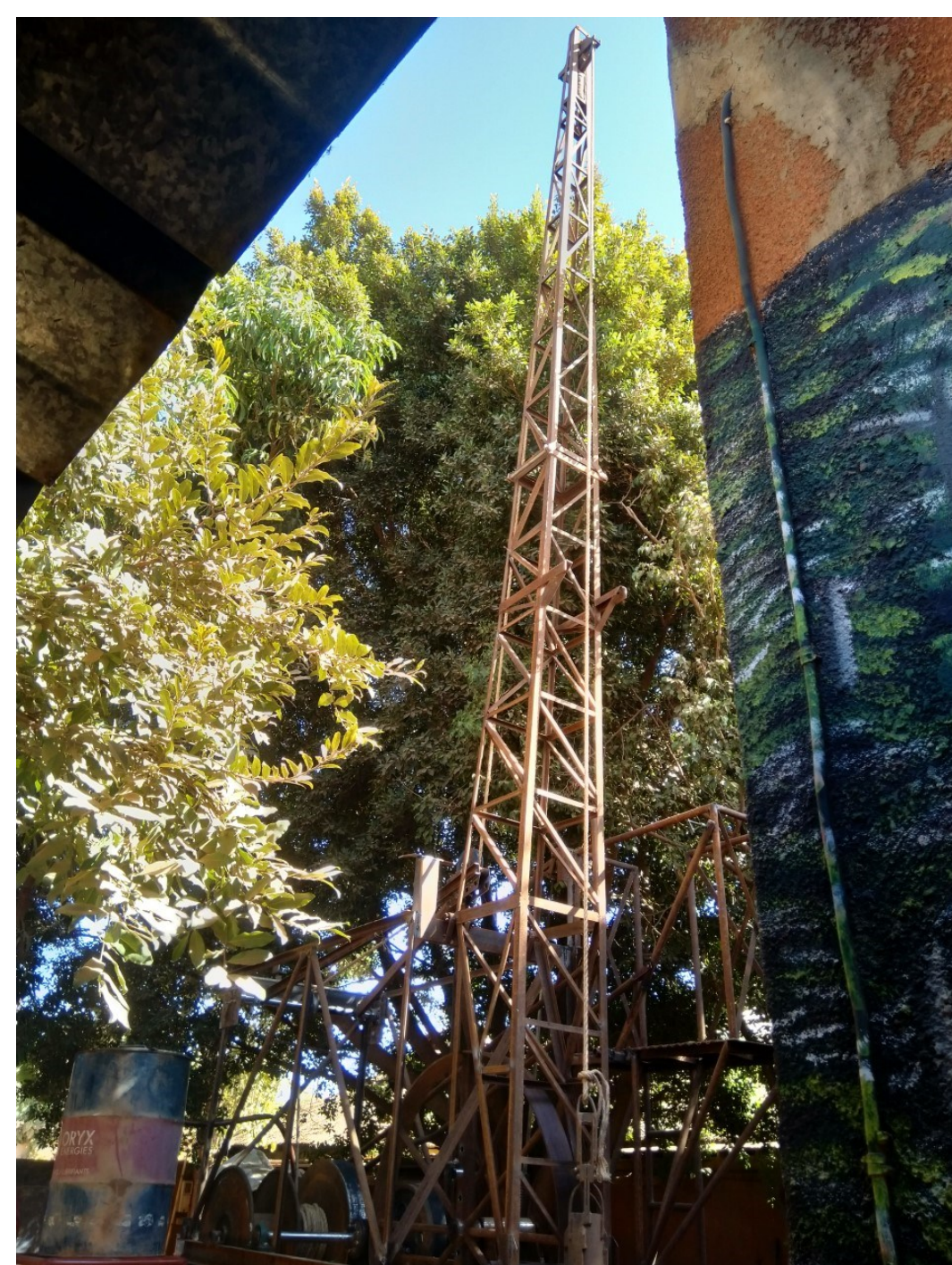


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Matthew Merlo, Matthew Siegrist, Jacob Wildasin

Introduction

The MPWD team is currently working to provide recommendations to improve the useful service life of our client's new, mechanized percussion well drilling rig design. The rig is designed to drill shallow water wells in West Africa, where some of the more rural regions have limited access to water. The team has designed and fabricated a testing rig to simulate the operation of our client's full-size rig. This will allow our team to conduct fatigue testing on a model of the driveline system to estimate its expected service life. The team performed finite element analyses on the mast design of our client's rig to evaluate working stresses under static loading and buckling, along with fatigue analysis, to confirm safe operation of the rig and to identify any elements that might require upgrades.



Client

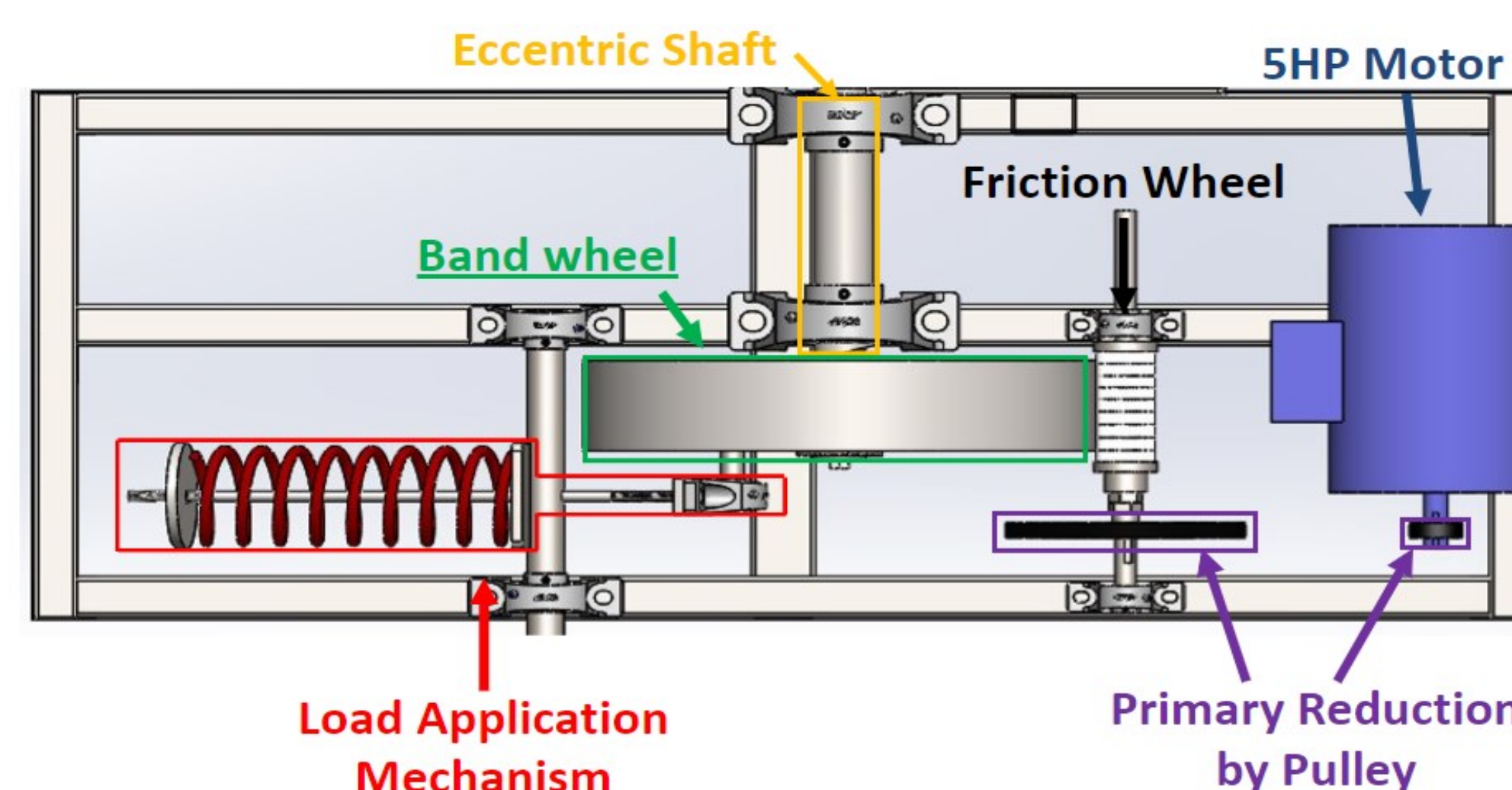
Joseph Longenecker, Open Door Development (ODD)

Joseph Longenecker, along with his family, has been working in West Africa for 3 years. He graduated from Messiah College in 2006, and traveled to West Africa with his Collaboratory team when he was a student. He currently serves as the liaison between ODD and Messiah University. ODD's mission is to share the gospel by equipping the local church for community service and by ministering to human needs. Joseph particularly wants to help teach young engineers to meet needs for Christ's sake. Joseph's main work is developing a well drilling rig to be used in West Africa.



Fatigue Testing

The team is conducting a fatigue test on the driveline system to determine anticipated lifetime and analyze the wear patterns in the rubber friction wheel. In order to undergo a fatigue test, a testing rig was designed and constructed. The testing rig is designed to simulate the loads that our client's rig experiences, using a compression spring instead of an actual drill bit.



Based on the SolidWorks model, the team is constructing a testing rig that will be used for fatigue testing.



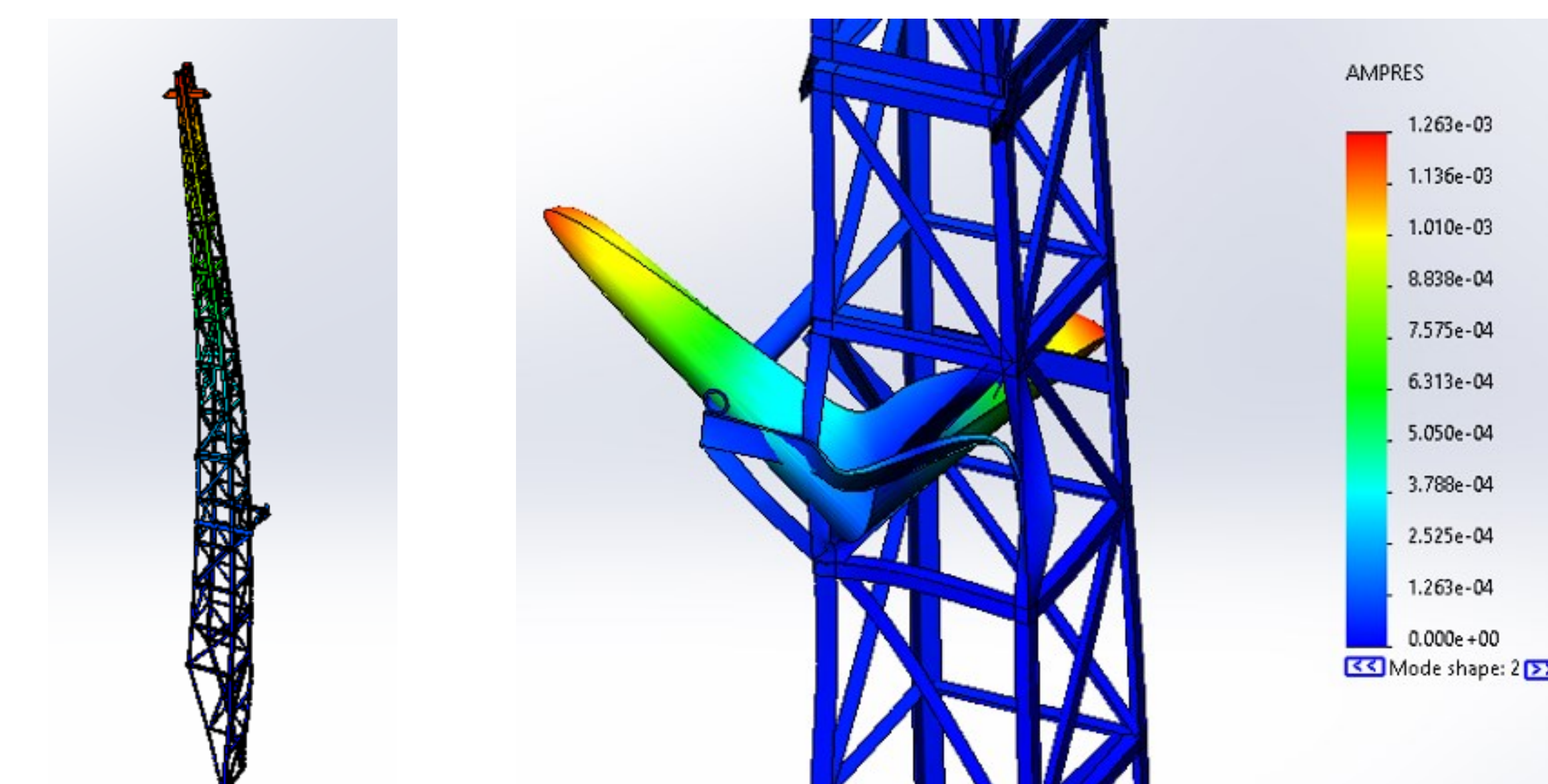
Our Team

From left to right: Matthew Merlo, Jacob Wildasin, Prof. Scott Heisey, Robert Donley, Matthew Siegrist, Matthew Higgs



SolidWorks Finite Element Analysis

After our team created a model of our client's drilling mast, we ran a static loading study, two buckling studies, and a fatigue study to identify any elements that require upgrades. The most critical factor of safety was 2.7 from the pulling casing buckling study (shown at right). Based on these results, we recommended that the size of the angle iron be increased around the section of failure.



Conclusion

- Through the work completed this year, our team has fabricated a testing rig that will accurately represent the same loading on our client's rig. This rig will be used to measure the wear of the rubber on the friction wheel and ultimately provide our client with an estimate of the usable service lifetime of his rig.
- The team has identified the critical factor of safety in the mast to be 2.7 due to pulling casing buckling. We recommended that the angle iron thickness be increased in this area.

Acknowledgements

- Project Manager:** Prof. Scott Heisey
- Advising Engineers:** John Meyer, Dr. Tim Van Dyke, Andy Erikson
- Panelists:** Tommy Denlinger, Rob Ebner, Michael Guion, Josh Joyce, Ray Norman, Jonathan Shenk
- Fabrication:** E & E Metal Fabrication Inc.

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