Design of Mechanically Fastened Rail Road Wheels

Overview
Penn Machine tasked us with redesigning the wheel-axle interface on transit train cars. The current technology utilizes a press fit between the wheel and axle and therefore requires the use of a large hydraulic press. This creates problems when replacing the wheels. Penn Machine wanted a new design that would reduce maintenance time on the wheels and, thus, save money.

Objectives
Our objective was to come up with a new, innovative design for attaching a transit train wheel to an axle. The final design should allow for quick and relatively simple replacement of the wheels. Ideally, the replacement could take place on site, without any part of the train being removed from the track or disassembled.

Approach
- Assessed customer needs
- Researched existing patents and current technologies
- Held multiple brainstorming sessions to generate concepts
- Narrowed our concepts to four ideas and met with our sponsor to get their evaluation/input
- Implemented our sponsor’s ideas and expertise into our design to select a final concept
- Created solid models of our selected concept using SolidWorks
- Performed FEA using SolidWorks and Abaqus
- Used 3D-printing to create two initial prototypes
- Created a final ¼-scale prototype using a casted aluminium wheel

Outcomes
- Our design allows for replacement of the wheels with a specialized tool that is portable and easy to use.
- This design, if implemented, will significantly reduce downtime. If a transit company does not have a press, which many do not, they will not need to send the wheel-axle assembly to an off-site facility to have a wheel replaced.
- The initial FEA results were very promising, enough that Penn Machine filed for a patent for the technology and is planning to make a substantial investment in further developing this design.