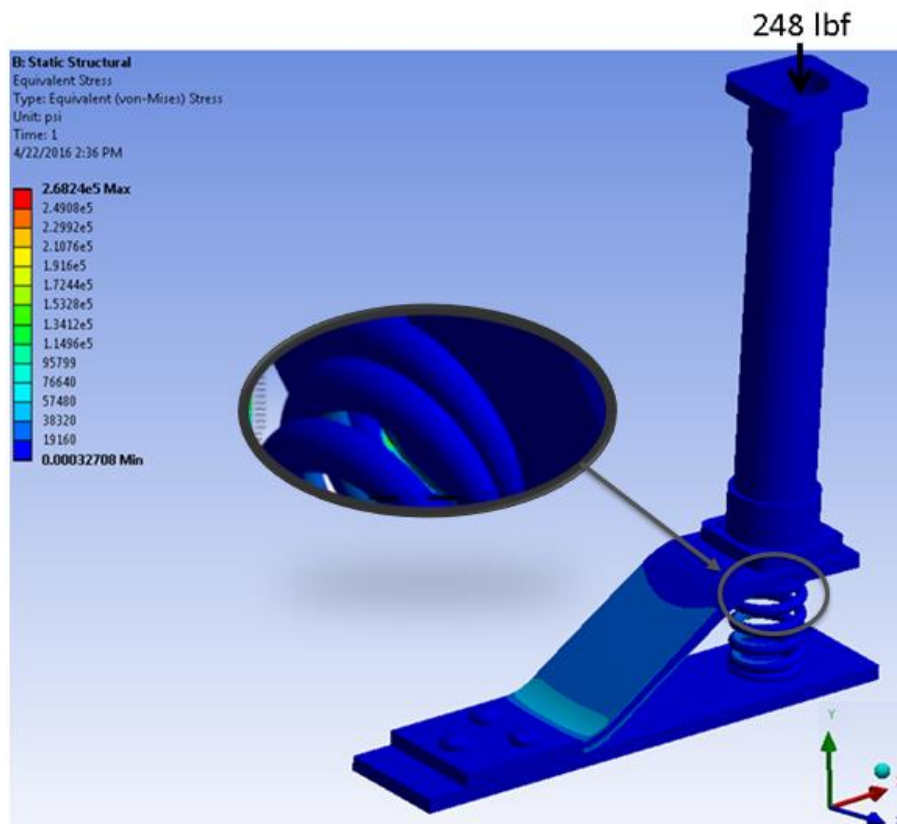


## Designing and Analyzing a Low Cost Prosthetic Limb

Transfemoral prostheses are available for people who have a limb amputation below the knee. The amputation can be a result of diabetes, vascular diseases, congenital, cancer, or trauma. People, with transfemoral amputation, fitted with a prosthesis regain mobility and independence. The cost of the prosthesis varies, depending on the design; materials used, and function of the user. The prosthetic limb, in general, needs to be replaced every 3-4 years due to wear and tear. The purpose of this study is to design and build a low cost transfemoral prosthesis, and use computer modelling to examine the force/stress distribution within the prosthetic limb.

The objectives of the project are: (1) to design a low cost transfemoral prosthesis; (2) to perform a computational analysis of the stress distribution within the design so as to optimize the design; (3) once the device is built, have the test subject with transfemoral amputation try on the prosthesis and to compare for comfort, ground reaction force, center of pressure, and mobility.

A Solidworks model of the prosthesis was built and imported into ANSYS for finite element analysis. The assembly displayed in Figure 1 was then analyzed by first applying a force of 248 lbs to the top of the assembly where the socket would attach, and the flat plate at the bottom of the assembly was treated as a fixed support. This simulates the midstance of the stance phase of the gait cycle. The equivalent stress was measured in order to find the areas with a high stress concentration.



**Figure 1:** Assembly 1, equivalent stress distribution.

The process to build this prosthetic limb was relatively short and simple compared to that of modern prostheses. The final product is displayed in Figure 2, shown below.



**Figure 2:** Completed prosthetic limb without the socket.

The low cost prosthetic limb was made at a fraction of the cost of base level modern prostheses (\$124.71). The materials that were used are commonly found in any country. The low cost prosthesis simulates the gait cycle closely. The cost savings of the low cost prosthesis as well as the simple construction process make this a strong base model for the field of low cost prosthesis.