# 3D Printable Prosthetic Foot

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The goal of this project is to design a cost effective, 3D printable biocompatible prosthetic foot, capable of facilitating full function with little compromised gait. 3D printing enables the optimization of material properties, to mimic the function of the limb the prosthetic foot is replacing. A study of high school runners led to the analysis of forces that affect movement, and a final design that delivers 124% in kinetic energy transfer and output. This level of potential energy storage resulted in an increased safety factor of 5.52ul, 0.36% variance from a perfect rating of 5.50ul. Applied physics and mathematics were used to quantify the adverse impact of gap co-linear compression and its effect on material properties and structural integrity. Tests involving complex cantilever beams utilized differential equations to compare stress, strain modulus, and compressive strength. This led to the development of two equations to calculate discrepancies between ASTM standards and each 3D printed part, where the discrepancies resulted from the gap co-linear compression. Graphical analysis confirmed biocompatibility associated with a level 4 prosthetic, with 5.3% compromised gait, capable of sustained intensive movement. The 3D printed Nylon 6/6 design can be easily scaled, redesigned and reprinted as needed to accommodate human growth. Each reprinting will cost no more than $23 in materials, compared to the $18,000 it costs to replace a standard prosthetic foot. The result is an affordable, 3D printable prosthetic foot that exceeds basic ambulation capability and allows active adult function for a fraction of the cost.

**Awards Won:**

First Award of $5,000

International Council on Systems Engineering - INCOSE: Second award of $500