Research and Development of an Extremely Affordable Prosthetic Knee

Victor H. Duenas  
*Department of Mechanical Engineering, University of Texas at El Paso, vhduenasfontes@miners.utep.edu*

Noe Vargas-Hernandez  
*Department of Mechanical Engineering, University of Texas at El Paso, nvargas@utep.edu*

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The objective of this research and development work is to apply the design process in a prosthetic knee mechanism. The importance of human knee is founded in the provided mobility, body positioning and support of the body weight. But for amputees, limitations for everyday tasks imply a real challenge. The project scope a cycle involving the social need, the development and the supply of the solution layout. The motivation is to improve life quality through voluntary and independent human movement by providing a low cost knee design.

The design process requires the conceptual, embodiment, detail and evaluation phases to complete the model. Knee design includes methodologies and tools to achieve the desired functionality related to existing marketed products: development of the state of the art and theoretical study (gait analysis, knee biomechanics and ergonomics), creation of a 3-D model using CAD (Computer-aided design) software to test stability, assembly, kinematics and structure, and to advance in design's validation and simulation.

Based on the functions, the analysis yielded solution variants with qualitative and quantitative constraints. Solutions were tested using the structural and kinematic simulation in NX 7.5™ to evaluate safety, quality and other criteria. The final design obtained improvement on key aspects following pre-established guidelines, requiring more physical investigation and testing, with the potential to excel in functionality by extending performance requirements and reducing costs. The project will bring interest in biomechanics and to future marketing and production processes.