# X-ray Image Based Cosmetic Limb Design

Dr.Ravi kumar[#1],Associate Professor(Sr.Gr),Department of Biomedical Engineering

Mohanapriya.G[#2], Moneesha.S[#3], Saravanan.K[#3], Seenivasa prabhu.N[#4]

*Department of biomedical engineering,*

*velalar college of engineering and technology.*

***Abstract- The paper introduces about the residual limb design using an x-ray image of an amputed patient. Customization of socket is important to obtain the best adaptability of the patient's body, swearing a high functional degree, comfort , durability and prevention of medical complication. Till now, lower limb designed and manufactured` using MRI,CT images. Our research aims at introducing the use of MATLAB and tools in this context ,where they are not commonly used. The methodologies consists of the reconstruction of stump ,simulations on the digital model for obtaining the stump deformed shape and socket manufacturing .Finally the last step consists of force analysis and temperature analysis using Ansys software.***

## *I.* INTRODUCTION

The successful design and fitting of a prosthetic socket results in the effective transfer of forces from the socket to the residual limb, such as the amputee can maintain daily activities without damaging tissue or experiencing pain the most common reason for residual limb pain is due to an intolerable pressure applied to the stump[1]. Lower limb amputation may be caused due to peripheral vascular disorder ,diabetes ,infection, foot ulcer, trauma, tumor/cancer So uncomfortable socket may cause many clinical problems, such as dermatitis or skin lesions. The residual limb design vary from person to person such as geometry , size and load bearing tolerance. Reconstruction using CREO software is carried out using certain tools. The surface shape of ampute is acquired using an x-ray[3].

Most of the previous works on prosthetic design is based on manual design . With a manual design, the most common way of defining the shape of a residual limb is to make a mould of the residual limb itself. This method is prone to deviations caused by human error[7].One of the advantage of using this method is very low cost and it lowers the risk of the patient[4].Using the reconstructed 3D image would also be more comfortable for the patient when compared to using a traditional fabrication,as it may cause more injury during the design.

The aim of this paper is to provide a system which uses a 3D reconstruction technique that is capable of producing the measurement of the limb in order to provide an easy and accurate measure of residual limb and creating a missing part of the limb[11].

## II. RESIDUAL STUMP MEASUREMENT USING X-RAY

The reconstruction of the stump digital model acquired by x-ray medical imaging(complete residual limb with bone structure and dermis).The problems related to 3D geometric reconstruction namely the patient and stump positioning is considered for defining a protocol procedure with the requested accuracy for socket production .The second step consists of comparing the digital model and the one obtained by the 3D model. The obtained results demonstrate the data as follows

- To acquire the morphology of the stump in less invasive way for the patient.
- To have textured digital model, which permit an easy evaluation of the assessment suffered by limb.
- To detect the variations of shape and volume[2]

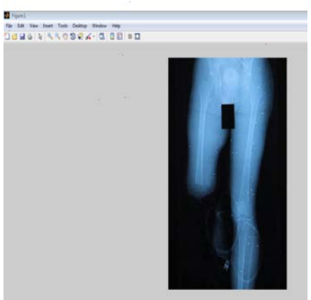
## III. 3D DESIGN WITH CREO

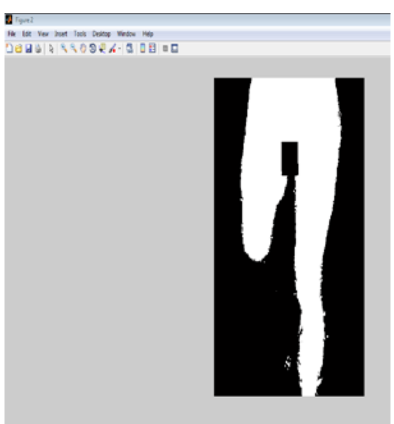
CREO is a software which belongs to the family of designing a product and it is developed using PTC. Using the details obtained from the matlab stump is constructed by the measurements taken. Three dimensional image is reconstructed with a CREO which presents a better correspondence to the real skin surface[6] .It shows all the abnormalities due to ampution, stump condition and socket possible interaction. We use this model as reference for the complete 3D reconstructed model [8.] To obtain the 3D digital integrated stump together with the external surface and the inner bony structure. The 3D view consists of measured parameters from the x-ray image of an residual limb[12].

## IV. RESULTS AND DISCUSSION

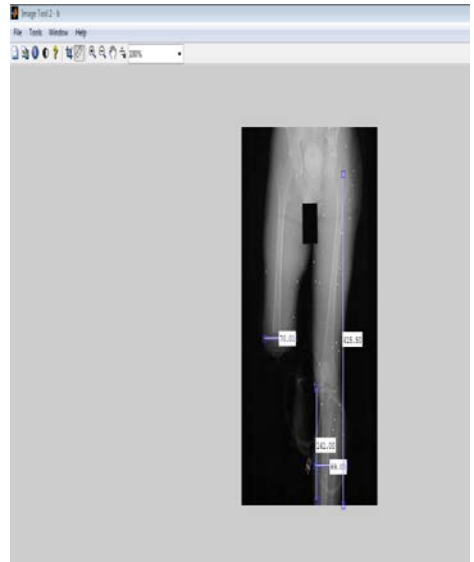
The results obtained by using MATLAB with some tools

The first step is carried using segmentation process in which it consists of segmentation algorithms in which the boundary is detected. The value of pixels at the boundary is noted and the edge is detected by using suitable codes.





2. Distance is measured using distance tool.



3.Force analysis and temperature analysis is done using Ansys software.

## V. CONCLUSION

The paper presented a methodology to customize prosthesis socket where all phases and all data involved in the process are digital .It discuss about specific problems related to the geometric model of stump. We compared acquired 3d geometric model and the cast obtained in a traditional way. The main role is played by the geometric digital data of the lower residual limb, which replaces the plaster cast and basis of socket design.

## VI. REFERENCES

[1]. Buis A.W.P., Condon B., Brennan D., McHugh B., Hadley D., (2006): Magnetic resonance imaging technology in transtibial socket research: A pilot study, Journal of Rehabilitation Research & Development JRRD, Volume 43, Number 7, pp. 883–890.

[2]. Besl P. and McKay N., “A Method for

[3]. Registration of 3d Shapes,” IEEE Transactions on Pattern Analysis and Machine Intelligence, vol.14, no. 2, pp. 239-25, 1992.

[4]. 3.Davis R. B., Ounpuu S., Tyburski D., Gage J. R., (1991): A Gait Analysis Data Collection and Reduction Technique, Journal of Human Movement Science, 5, vol.10, Newington, Connecticut, April 1991

[5]. Douglas T.S., Solomonidis S.E., Lee V.S.P., Spence W.D., Sandham W.A., Hadley D.M., (1998): Automatic segmentation of magnetic resonance images of the trans-femoral residual

limb, Medical Engineering & Physics 20, pp.756–76.

[6]. 5.Faugeras O., Three-Dimensional Computer

[7]. Vision: A Geometric Viewpoint, Massachusetts Institute of Technology Press,1993.

[8]. 6. Fremont V. and Chellali R., “Turntable-Based 3D Object Reconstruction,” in Proceedings of IEEE conference on Cybernetics and Intelligent Systems, France, pp. 1277-1282, 2004.

[9]. Lee W. C. C., Zhang M., Jia X., Cheung J. T. M. (2004): Finite element modeling of the contact interface between trans-tibial residual limb and prosthetic socket, Medical Engineering and Physics, vol. 26, no. 8, pp. 655-662 .

[10]. Ming Z., Roberts C. (2000): Comparison of computational analysis with clinical measurement

[11]. of stresses on below-knee residual limb in a prosthetic socket, Medical Engineering and

[12]. Physics, vol. 22, pp. 607-612.

[13]. 9.Nawijn SE, H van der Linde, CH Emmelot, CJ Hofstad (2005): Stump management after transtibial amputation: A systematic review. Prosthetics & Orthotics International, 29(1) pp. 13-26.

[14]. 10. Neumann E. S., Wong J. S., Drollinger R. L., (2005): Concepts of Pressure in an Ischial

[15]. Containment Socket: Measurement, Journal of Prosthetics and Orthotics, Vol 17, Num 1, p 2.

[16]. 11. Seymour R., Prosthetics and Orthotics-LowerLimb and Spinal, Lippincott, Williams andWilkins, 2002

[17]. 12.Smith KE, Commean PK, Robertson DD, Pilgram T, Mueller MJ. (2001):Precision and

[18]. accuracy of computed tomography foot measurements, Arch Phys Med Rehabil, 82: pp. 925-9.