

Vol III Issue V June 2013

Impact Factor : 0.2105

ISSN No : 2230-7850

Monthly Multidisciplinary
Research Journal

*Indian Streams
Research Journal*

Executive Editor

Ashok Yakkaldevi

Editor-in-chief

H.N.Jagtap

IMPACT FACTOR : 0.2105

Welcome to ISRJ

RNI MAHMUL/2011/38595

ISSN No.2230-7850

Indian Streams Research Journal is a multidisciplinary research journal, published monthly in English, Hindi & Marathi Language. All research papers submitted to the journal will be double - blind peer reviewed referred by members of the editorial Board readers will include investigator in universities, research institutes government and industry with research interest in the general subjects.

International Advisory Board

Flávio de São Pedro Filho Federal University of Rondonia, Brazil	Mohammad Hailat Dept. of Mathematical Sciences, University of South Carolina Aiken, Aiken SC 29801	Hasan Baktir English Language and Literature Department, Kayseri
Kamani Perera Regional Centre For Strategic Studies, Sri Lanka	Abdullah Sabbagh Engineering Studies, Sydney	Ghayoor Abbas Chotana Department of Chemistry, Lahore University of Management Sciences [PK]
Janaki Sinnasamy Librarian, University of Malaya [Malaysia]	Catalina Neculai University of Coventry, UK	Anna Maria Constantinovici AL. I. Cuza University, Romania
Romona Mihaila Spiru Haret University, Romania	Ecaterina Patrascu Spiru Haret University, Bucharest	Horia Patrascu Spiru Haret University, Bucharest, Romania
Delia Serbescu Spiru Haret University, Bucharest, Romania	Loredana Bosca Spiru Haret University, Romania	Ilie Pinteau, Spiru Haret University, Romania
Anurag Misra DBS College, Kanpur	Fabricio Moraes de Almeida Federal University of Rondonia, Brazil	Xiaohua Yang PhD, USA
Titus Pop	George - Calin SERITAN Postdoctoral Researcher	Nawab Ali Khan College of Business Administration

Editorial Board

Pratap Vyamktrao Naikwade ASP College Devrukh,Ratnagiri,MS India	Iresh Swami Ex - VC. Solapur University, Solapur	Rajendra Shendge Director, B.C.U.D. Solapur University, Solapur
R. R. Patil Head Geology Department Solapur University, Solapur	N.S. Dhaygude Ex. Prin. Dayanand College, Solapur	R. R. Yaliker Director Managment Institute, Solapur
Rama Bhosale Prin. and Jt. Director Higher Education, Panvel	Narendra Kadu Jt. Director Higher Education, Pune	Umesh Rajderkar Head Humanities & Social Science YCMOU, Nashik
Salve R. N. Department of Sociology, Shivaji University, Kolhapur	K. M. Bhandarkar Praful Patel College of Education, Gondia	S. R. Pandya Head Education Dept. Mumbai University, Mumbai
Govind P. Shinde Bharati Vidyapeeth School of Distance Education Center, Navi Mumbai	Sonal Singh Vikram University, Ujjain	Alka Darshan Shrivastava Shaskiya Snatkottar Mahavidyalaya, Dhar
Chakane Sanjay Dnyaneshwar Arts, Science & Commerce College, Indapur, Pune	G. P. Patankar S. D. M. Degree College, Honavar, Karnataka	Rahul Shriram Sudke Devi Ahilya Vishwavidyalaya, Indore
Awadhesh Kumar Shirotriya Secretary, Play India Play (Trust),Meerut	Maj. S. Bakhtiar Choudhary Director,Hyderabad AP India.	S.KANNAN Ph.D , Annamalai University,TN
	S.Parvathi Devi Ph.D.-University of Allahabad	Satish Kumar Kalhotra
	Sonal Singh	

**Address:-Ashok Yakkaldevi 258/34, Raviwar Peth, Solapur - 413 005 Maharashtra, India
Cell : 9595 359 435, Ph No: 02172372010 Email: ayisrj@yahoo.in Website: www.isrj.net**



MODELLING AND ANALYSIS OF A MULTIFUNCTIONAL CRUTCH

T.S.MOHAN KUMAR AND K.V.MAHENDRA

1Assistant Professor Department of Mechanical Engineering Jyothy
Institute of Technology Tataguni Bangalore.
Principal Department of Mechanical Engineering Jyothy Institute
of Technology Tataguni Bangalore-

Abstract:

Devices like walking sticks, walkers, crutches, artificial limbs are in use for improving the mobility of orthopaedically disabled persons. It is disheartening to note that about twenty million people in India are disabled of which about ten million are orthopaedically disabled. Elderly people have the difficulty of walking longer distances without support.. The development of this multipurpose crutch is simple facilitating easy manufacture and assembly. Various concepts were generated to meet the requirement of the problem. These concepts were evaluated based on important criteria using a concept scoring matrix and the modular design concept, which scored high, was selected for development. The detailed design and optimization was carried out for selected concept using the solid modeling software.

KEYWORDS:

Crutch, orthopaedically disabled ,concept scoring matrix .

INTRODUCTION

Assistive devices like walking sticks, walkers, crutches, artificial limbs are in use for improving the mobility of orthopaedically disabled persons. It is disheartening to note that about twenty million people in India are disabled of which about ten million are orthopaedically disabled, having limited mobility and restricted muscular coordination. Orthopaedically disability could be with regard to leg, arms or spinal cord. The cause could be due to polio, cerebral palsy at birth or acquired due to spinal cord injury or paralysis. The disability to walk could be due to the above causes or arthritis, surgery of hip, leg or knee, fibromyalgia, back injury or any other physical condition. Elderly people have the difficulty of walking longer distances without support. There are various types of assistive devices for providing mobility thereby enhancing the quality of life of a disabled person. Efforts should be made to ensure that these are affordable even by the underprivileged section of the society.

Among all the assistive devices used by the orthopaedically disabled and elderly people, a Crutch is most widely used. It is the simplest assistive device for supporting a person during walking. It is universally used by people to provide balance in walking.

With these considerations in view, a new multipurpose crutch which can be converted to a seat to assist people who get tired during walking or standing for a long time has been developed and fabricated. Study of similar equipment elsewhere and market survey to establish the exact requirements has been made before arriving at this concept. This concept was finalized after interviewing and discussing with various people who are using crutches and studying their views.

The development of this multipurpose crutch is simple facilitating easy manufacture and assembly. Various concepts were generated to meet the requirement of the problem. These concepts were evaluated based on important criteria using a concept scoring matrix and the modular design concept,

which scored high, was selected for development. The detailed design and optimization was carried out for selected concept using the solid modeling software.

It uses the basic principle of four bar mechanism for folding the seat. It consists of minimum number of parts forming the three legs of the tripod, links, pivots and the seat. When the crutch is converted into a seat, a wide base of nearly 250mm to 350mm is created on the ground. The seat is formed at the centre so that the weight of the person sitting on the seat falls well within the triangle and provides stability. The legs are made of tubular steel to provide strength at minimum possible weight. The linkages and pivots are made of steel to provide maximum strength.

The multifunctional crutch was manufactured at MERU Precision Industries, Rajajinagar, Bangalore. The prototype was demonstrated at “MOBILITY INDIA”, a centre for

Type of disability	Population in millions
Orthopaedically disabled	10.1
Visual	4.6
Hearing	3.7
Speech	2.2
Total	20.5 (Approx 2%)

Welfare of Disabled Persons. It was well appreciated by the inmates.

It is hoped that this multipurpose crutch would meet the requirement of elderly people and disabled people. It is felt that this device would also be useful for persons who have to be on their feet for long periods during the execution of their duties.

PROBLEM DEFINITION

Based on the analysis of the data collected by administering the questionnaire the problem was defined as “To develop and fabricate a multifunctional Crutch to assist orthopaedically disabled people The crutch should be provided with a foldable seat and a mechanism to convert the stick into a seat to facilitate resting. It should be light weight, easy to carry, easy to manufacture and use, ergonomic and aesthetic in design and cost effective.

CRUTCH WITH SEATING TYPE (FOUR BAR MECHANISM)



FIG1 3D MODEL OF THE CRUTCH

ANALYSIS APPROACH

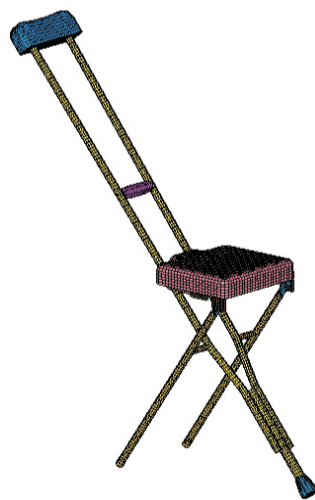
Hypermesh is used as pre-processor
 ANSYS is used as Solver and post processor
 Static and Eigen Buckling analysis is done for the multifunctional Crutch
 Crutch pad, Crutch tip, Hand grip and Wooden seat are modeled with Solid45 elements (Hexa / Penta elements)
 Hinge, Links, Seating attachment legs, Crutch main leg,

Tools Used	Hypermesh
Mesh Type	Shell and Solid
Element Size	5 mm
No. of Shell Elements	5738
No. of Solid Elements	7100
No. of nodes	14814

and Spacer are modeled with Shell63 (4 and 3 noded shell elements)
 Bolts / Pins are simulated by CERIG elements (Rigid Elements)

Material properties

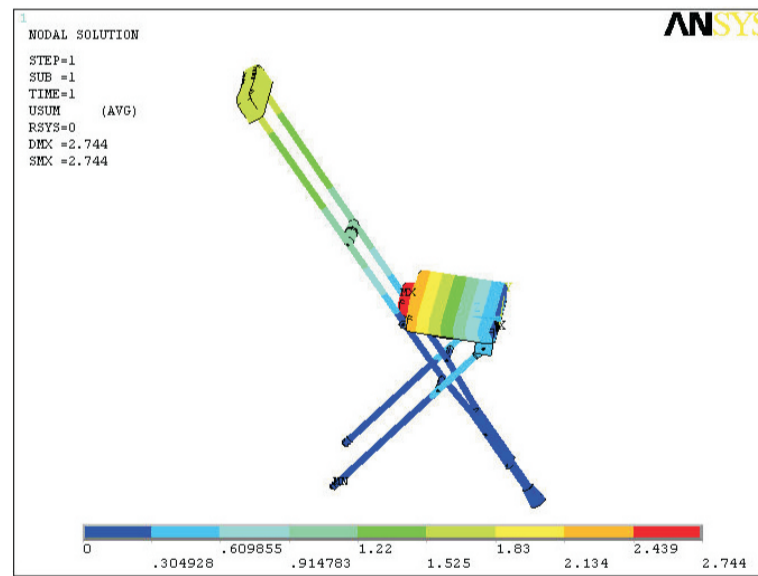
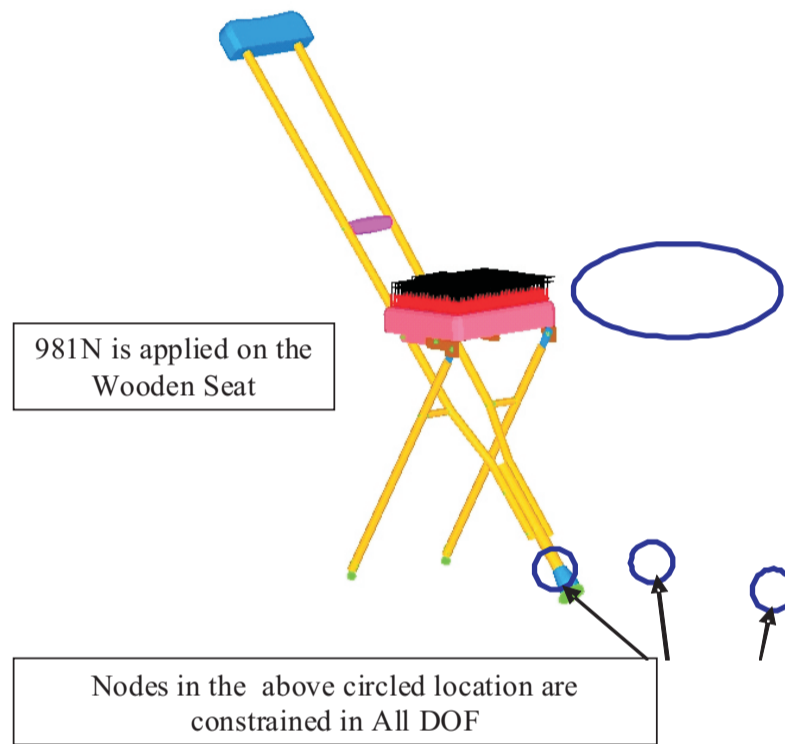
Component	Young's Modulus (N/mm ²)	Poisson's Ratio
Aluminium	7.0 E+4	0.33
Wood	1.5 E +4	0.46



Displacement

Name : Plot 1
Type: Displacement
Min: 0
Max:2.74mm

Static Analysis: Loads and Boundary Conditions



CONCLUSION:

The Design thickness of the link plate taken in the analysis is 3mm. It has been observed that increasing the thickness of the link plate to 5mm the stresses and deformation reduces by 50%.

RESULTS AND DISCUSSIONS

A multifunctional crutch has been successfully designed and developed. It is hoped that this product will be very useful to orthopaedically disabled persons and who find difficulty in walking and who need to rest frequently during walking. The multifunctional seating attachment was analyzed using Ansys 11 under static analysis for stress and deformation

The displacement was found to be 2.74 mm and the stress at the link is about 154.4Mpa . This can be further reduced by increasing the thickness of the Link plate used .

REFERENCES:

1. Miss Wilhelmine, "Crutch – Walking as an Art", American Journal of Surgery, New Series, I, 372, December 1926.
2. Lowman EW, Rusk HA: Self help devices: Crutch prescriptions and measurement. Postgrad Med 31:303-305, 1962.
3. Stuart L: Method of measurement for walking appliances. Canadian Journal of Occupational Therapy 32:87-88, 1965.
4. Deaver GG: What every physician should know about the teaching of crutch walking. JAMA 142:470-472, 1950.
5. Childs TF: An analysis of the swing-through crutch gait. Phys Ther 44:804-807, 1964.
6. Peacock B: A myographic and photographic study of walking with crutches. Physiotherapy 52:264, 1968.
7. Shoup TE, Fletcher LS, Merrill BR: Biomechanics of crutch locomotion. J Biomech 7:11-19, 1974.
8. Seireg AH, Murray MP, Scholz RC: Method for recording the time, magnitude and orientation of forces applied to crutches. Am J Phys Med 47:307-314, 1968.
9. Murray MP, Seireg AH, Scholz RC: A survey of the time magnitude, and orientation of forces applied to walking sticks by disabled men. Am J Phys Med 48:1-13, 1969.
10. Baxter ML, Allington Ro, Koepke GH: Weight distribution variables in the use of crutches and canes, Phys Ther 49:360-365, 1969.
11. Determining the length of crutches. Modern Hospital 15:332, 1920.
12. Olmsted L: Crutch walking. Am J Nrs 45:28-35, 1945

Publish Research Article International Level Multidisciplinary Research Journal For All Subjects

Dear Sir/Mam,

We invite unpublished research paper.Summary of Research Project,Theses,Books and Books Review of publication,you will be pleased to know that our journals are

Associated and Indexed,India

- * International Scientific Journal Consortium Scientific
- * OPEN J-GATE

Associated and Indexed,USA

- Google Scholar
- EBSCO
- DOAJ
- Index Copernicus
- Publication Index
- Academic Journal Database
- Contemporary Research Index
- Academic Paper Databse
- Digital Journals Database
- Current Index to Scholarly Journals
- Elite Scientific Journal Archive
- Directory Of Academic Resources
- Scholar Journal Index
- Recent Science Index
- Scientific Resources Database

Indian Streams Research Journal
258/34 Raviwar Peth Solapur-413005,Maharashtra
Contact-9595359435
E-Mail-ayisrj@yahoo.in/ayisrj2011@gmail.com
Website : www.isrj.net