RESEARCH PAPER PUBLICATIONS IN 2021-22

Number of research papers published per teacher in the Journals notified on UGC care list during the year 2021-22

Prof. Dr. Benny Joseph
Signature Not Verified
(PRINCIPAL)
Principal.VJEC

1(2021-22)

Electric Power Components and Systems, 48(14-15): 1584–1597, 2020

ISSN: print / online
DOI: 10.1080/15325008.2020.1857473

Taylor & Francis
Taylor & Francis Group

Check for updates

Maximum Power Tracking and Power Sharing in Grid Connected WECS Using Modified PFC Rectifier and PR Controlled Inverter

Teena George and Jayaprakash Pychadathil
Department of Electrical and Electronics Engineering, Government College of Engineering Kannur, A. P. J. Abdul Kalam Technological University, Thiruvananthapuram, Kerala, India

CONTENTS

Abstract—This article presents an improved maximum power tracking and power sharing technique by using a self-recurrent wavelet neural network (SRWNN) controller. A power factor correction (PFC) rectifier as machine-side converter and proportional resonant (PR) controlled three-phase inverter as grid-side converter for wind energy conversion system (WECS) is presented. The modified PFC rectifier ensures the machine to work at maximum power coefficient, by using a sensor less SRWNN controller. Hence, it extracts maximum power at various wind speeds and provides unity power factor operation at generator side so as to increase the efficiency. The PR controlled inverter ensures proper real and reactive power sharing with the grid, which also acts as a distribution static compensator (DSTATCOM), by casting off harmonics at the grid side for nonlinear loads. The wind turbine, generator, converter and controller are modeled in MATLAB/Simulink platform and performance is analyzed for maximum power tracking and power sharing for a 40kVA, 400 V WECS. An extensive analysis of the proposed system is carried out in a developed experimental setup and the results validate the theoretical claims.

1. INTRODUCTION

Existing power generation schemes are creating a high amount of environmental issues and are facing problems due to insufficient fossil fuels, which is to be replaced with robust, sustainable, and environmentally friendly power generating schemes, utilizing renewable energy resources. The variable-speed wind energy conversion systems

Signature Not Verified
Principal.VJEC

Materials Performance and Characterization

doi:10.1520/MPC20200075 / Vol. 10 / No. 1 / 2021 / available online at www.astm.org

R. Malkiya Rasalin Prince,[1] N. Selvakumar,[2] D. Arulkirubakaran,[3] S. Christopher Ezhil Singh,[4] M. Chrispin Das,[5] Praveen Kumar Bannaravuri,[3] R. Mercy Russelin Prabha,[6] J. Aldrin Raj,[7] and R. B. Jeen Robert[8]

ZrC-Impregnated Titanium-Based Coating as an Effective Lubricating Barrier for Artificial Hip Prosthesis

Reference

R. Malkiya Rasalin Prince, N. Selvakumar, D. Arulkirubakaran, S. Christopher Ezhil Singh, M. Chrispin Das, P. K. Bannaravuri, R. Mercy Russelin Prabha, J. Aldrin Raj, and R. B. Jeen Robert, "ZrC-Impregnated Titanium-Based Coating as an Effective Lubricating Barrier for Artificial Hip Prosthesis," *Materials Performance and Characterization* 10, no. 1 (2021): 1–17. https://doi.org/10.1520/MPC20200075

ABSTRACT

The important properties of implant materials are extended component life, wear resistance, and biocompatibility. The wear characteristics depend, for implant materials, on the nature of the implant, movement of joints, and usage of the part. Hard ceramic Ti-6Al-4V-2ZrC (Titanium (Ti), Aluminium (Al), Vanadium (V), Zirconium Carbide (ZrC)) was coated over stainless steel (SS) 316L for analyzing the wear and mechanical properties against E-52100 steel balls sliding for artificial hip joints. The coating crystallography was examined by X-ray diffraction analysis and the topography was inspected by an Atomic Force Microscope (AFM). The coating thickness has been measured as 5–6 μm using a scanning electron microscope (SEM), and the smooth surface roughness of 0.03 μm was measured using AFM. The Ti-6Al-4V-2ZrC coated surface nanohardness has been enhanced three times higher than uncoated. The ball-on-disk wear was investigated with a load of 2–3 N, sliding distance 110 m, and sliding velocity 0.25–0.95 m/s. The investigated wear rates are mostly higher than 10^{-5} mm^3/Nm, and the frictional coefficient reduces from 0.8 to 0.35. The morphology of worn surfaces was analyzed using SEM. Based on the improvement in nano-hardness, it is concluded that the Ti-6Al-4V-2ZrC coated SS 316L is a good replacement for an artificial hip joint because of its better wear resistance and coefficient of friction.

Keywords

Ti-6Al-4V-2ZrC films, artificial hip joint, wear and coefficient of friction (CoF), adhesion, nanoindentation

Manuscript received July 14, 2020; accepted for publication December 16, 2020; published online xxxx xx, xxxx. Issue published January 1, 2021.

[1] Department of Mechanical Engineering, Karunya Institute of Technology and Sciences, Karunya Nagar, Coimbatore, Tamilnadu 641114, India (Corresponding author), e-mail: russelmecher@gmail.com, http://orcid.org/0000-0003-3145-9511

[2] Department of Mechanical Engineering, Mepco Schlenk Engineering College, Mepco Nagar, Sivakasi 626005, Tamil Nadu, India

[3] Department of Mechanical Engineering, Karunya Institute of Technology and Sciences, Karunya Nagar, Coimbatore, Tamilnadu 641114, India

Received: 11 August 2020 | Revised: 11 December 2020 | Accepted: 17 December 2020

DOI: 10.1002/ima.22537

RESEARCH ARTICLE

WILEY

Early detection of breast malignancy using wavelet features and optimized classifier

Jayesh George Melekoodappattu[1] | **Anoop Balakrishnan Kadan**[1] | **V Anoop**[2]

[1]Department of Electronics and Communication Engineering, Vimal Jyothi Engineering College, Kannur, Kerala, India

[2]Department of Electronics and Communication Engineering, Jyothi Engineering College, Thrissur, Kerala, India

Correspondence
Jayesh George Melekoodappattu, Department of Electronics and Communication Engineering, Vimal Jyothi Engineering College, Kannur, Kerala, India.
Email: jayeshg1988@gmail.com and drjayeshgeorge@gmail.com

Abstract

Breast cancer considered to be a significant health issue among women. Early detection will ensure the treatment is easier and more successful. Recently, numerous methodologies have developed using medical imaging to investigate breast cancer. This research seeks to build a computer-aided diagnostic (CAD) system to interpret mammograms. The first stage of CAD includes preprocessing, Fuzzy c means based segmentation applied to a localized area. In the second stage of the CAD method, the extraction of the feature is carried out using three distinct wavelet families with decomposition level at 4 and 6. The ANN, SVM, and ELM classifiers are used in the final stage to enable accurate classification. This article proposes ELM with the Grasshopper Optimization Algorithm (ELM-GOA) to adjust the weight between the input and hidden layer to obtain maximum performance at the middle layer. This method adopts mammogram enhancement, optimum image segmentation, wavelet-based feature extraction, and grasshopper optimization algorithm based ELM to ameliorating the accuracy and reducing the computational cost. The result shows that ELM-GOA has precision and sensitivity of 100% and 98% respectively. The CAD system can identify tumors with 99.33 % accuracy.

Received: 10 March 2021 | Revised: 11 July 2021 | Accepted: 14 July 2021

DOI: 10.1002/ima.22635

RESEARCH ARTICLE

WILEY

Malignancy detection on mammograms by integrating modified convolutional neural network classifier and texture features

Jayesh George Melekoodappattu | **Anto Sahaya Dhas** | **Binil Kumar K.** | **K. S. Adarsh**

Department of Electronics and Communication Engineering, Vimal Jyothi Engineering College, Kannur, Kerala, 670632, India

Correspondence
Jayesh George Melekoodappattu, Department of Electronics and Communication Engineering, Vimal Jyothi Engineering College, Kannur, Kerala, India.
Email: drjayeshgeorge@gmail.com and jayeshg1988@gmail.com

Abstract

Breast cancer is detected by identifying malignancy on breast tissue. Emerging technologies in medical image processing are used to interpret histopathology images. For analyzing medical imaging and pathological data, modified deep neural networks are being used. Automatic detection of malignancy is usually achieved in deep learning by capturing features from a convolutional neural network (CNN) and then categorizing them using a fully connected network. A framework to automatically diagnose malignancy using an ensemble approach, including CNN and extraction of image texture features, is implemented in this research. In the CNN phase, the nine-layer modified CNN is used to classify images. Texture features are derived and their dimension is minimized using maximum variance unfolding to enhance the efficiency of classification in the extraction-based phase. The results of each phase were then merged to obtain the final decision. The testing specificity and accuracy of our ensemble method on MIAS repository are 98.9% and 99%, respectively

5(2021-22)

Automated Papaya Farm Monitoring system using Unmanned Aerial Vehicle (UAV)

Kiran joseph
PG Student
Dept. of electronics and communication engineering
Vimal Jyothi engineering college
Kannur, Kerala, India
kiran3ccc@gmail.com

Dr.D. Anto Sahaya Dhas
Professor
Dept. of electronics and communication engineering
Vimal Jyothi engineering college
Kannur, Kerala, India
dr.anto@vjec.ac.in

Dr. Jayesh George
Associate Professor
Dept. of electronics and communication engineering
Vimal Jyothi engineering college
Kannur, Kerala, India
jayeshg1988@vjec.ac.in

ABSTRACT *Papaya Farm monitoring plays a key role in taking the required early-stage steps to increase the efficiency of harvesting. Using Unmanned aerial vehicles (UAVs) we can increase the efficiency of faming and get maximum yield. Improving performance Unmanned aerial vehicles (UAVs) offer a quick and reliable means of collecting data from difficult to reach large farms. Awareness of the latest usability and technologies used in UAVs and the techniques of programming used to process images taken from UAVs. The approaches used to evaluate the stage of development with available algorithms. To plants, local binary patterns, distance transformation, and watershed segmentation methods are applied to pictures. Using YOLOv4 architecture trine the system to program to detect the plats and find the deficiency in it. this will help to monitor the large farm very easy. Papaya is one of the plants that have the we can find the deficiency of the tree by using monitoring the arial leaf images. at proper care of the plant yielding is can be improved. here with the help of ML (machine learning) the program can be done. using python, we are going to trine the system and gest the result from the program. making the use of available algorithms to modify the performance the get the best result up to loss parentage of 3. The available free were coding yolo is used to performing the task. Here we are using the lasted vision of YOLOv4. that improve the accuracy up to 97%. the increasing the iterations making the result best, here we use 3600 iterations for this project.*

1 INTRODUCTION

As technology is rapidly increasing, the equipment available is also progressing. We should gain the economical way to apply the available theologies to gain full output in order to increase agriculture yielding and to improve with large scale to accomplish this. Able to monitor the sector consistently is the biggest concern of agriculture. As a first step, we can obtain the result by using UAV to gain efficiency. To increase performance, understand the present theology. The control of development is limited. In order to achieve a high yield, large farms need continuous observation beginning from the early days of planting until harvesting times. The growth of planted trees has been impaired by insect pests, water drains and wild animals. If such issues are observed in the first stages of planting plants, they can be resolved, like stopping the final yield from decreasing. Early estimations with continuous control of the final yield. In particular, taking into account the scale and geography of the plantation farms, routine monitoring activities are difficult. Equipped with cameras and sensors, unmanned aerial vehicles (UAVs) offer a more effective solution to manual inspection of broad field plantations. Using aerial photos taken from UAV to suggest techniques for counting plants. Using photogrammetric point clouds generated from UAV images, several applications are demonstrated to recognise or characterise trees in 3D. The research focuses on automatic picture analysis from a UAV flying over large plantation regions. The device effectively blends cutting-edge UAV, GIS, stereophotogrammetry, and image processing technologies to help the plantation farm operator achieve the following objectives.

We arrived after a long journey from the hunters and gatherers of the past. Nowadays, people use the period to create a new way of living. People nowadays utilise this period to improve their day-to-day tasks. Harvesting vegetables and fruits on farms is an example. Human beings' major source of income is agriculture. Plants were discovered to be useful in the past by human ancestors. Agriculture has been practised by modern

6(2021-22)

RESEARCH ARTICLE

Deep learning-based robust medical image watermarking exploiting DCT and Harris hawks optimization

Anusha Chacko, Shanty Chacko

First published: 22 November 2021 | https://doi.org/10.1002/int.22742 | Citations: 1

Abstract

Image watermarking is an effective way to secure the ownership of digital photographs. This paper proposes a new methodology for integrating a watermark on the basis of various integrative strengths. The image is separated as 8 × 8 pixels blocks that do not overlap. The pixel size for each image block has been determined. For the embedding areas, picture blocks with the highest value have been chosen. Therefore, discrete cosine

Signature Not Verified

Principal.VJEC

7(2021-22)

Proceedings of the Computational Methods in Systems and Software
↳ CoMeSySo 2021: **Software Engineering Application in Informatics** pp 954–965 | Cite as

CSMI-AW: Computational System for Medical Image Authentication Using Watermarking

Anusha Chacko ✉ & Shanty Chacko

Conference paper | First Online: 17 November 2021
598 Accesses

Part of the Lecture Notes in Networks and Systems book series (LNNS,volume 232)

Abstract

Signature Not Verified

Principal.VJEC

Nuclear Engineering and Technology 54 (2022) 1588–1596

Contents lists available at ScienceDirect

Nuclear Engineering and Technology

journal homepage: www.elsevier.com/locate/net

Original Article

Prediction of fatigue crack initiation life in SA312 Type 304LN austenitic stainless steel straight pipes with notch

A. Ramachandra Murthy [a, *], S. Vishnuvardhan [a], K.V. Anjusha [b], P. Gandhi [a], P.K. Singh [c]

[a] CSIR-Structural Engineering Research Centre, Taramani, Chennai, India
[b] Vimal Jyothi Engineering College, Chemperi, Kerala, India
[c] Bhabha Atomic Research Centre, Trombay, Mumbai, India

ARTICLE INFO

Article history:
Received 14 September 2021
Received in revised form
21 October 2021
Accepted 12 November 2021
Available online 6 December 2021

Keywords:
Fatigue
Crack initiation life
Crack initiation models
Piping components
SA312 Type 304LN stainless Steel

ABSTRACT

In the nuclear power plants, stainless steel is widely used for fabrication of various components such as piping and pipe fittings. These piping components are subjected to cyclic loading due to start up and shut down of the nuclear power plants. The application of cyclic loading may lead to initiation of crack at stress raiser locations such as nozzle to piping connection, crown of piping bends etc. of the piping system. Crack initiation can also take place from the flaws which have gone unnoticed during manufacturing. Therefore, prediction of crack initiation life would help in decision making with respect to plant operational life. The primary objective of the present study is to compile various analytical models to predict the crack initiation life of the pipes with notch. Here notch simulates the stress raisers in the piping system. As a part of the study, Coffin-Manson equations have been benchmarked to predict the crack initiation life of pipe with notch. Analytical models proposed by Zheng et al. [1], Singh et al. [2], Yang Dong et al. [25], Masayuki et al. [33] and Liu et al. [3] were compiled to predict the crack initiation life of SA312 Type 304LN stainless steel pipe with notch under fatigue loading. Tensile and low cycle fatigue properties were evaluated for the same lot of SA312 Type 304LN stainless steel as that of pipe test. The predicted crack initiation lives by different models were compared with the experimental results of three pipes under different frequencies and loading conditions. It was observed that the predicted crack initiation life is in very good agreement with experimental results with maximum difference of ±10.0%.

1. Introduction

Fatigue is degradation mechanism that involves processes of crack initiation, its growth and fracture of components under repetitive stresses. This mechanism depends on the microstructural features of the material, loading amplitude and distribution of localized plastic deformation. The fatigue life of components/structures has broadly two phases, namely, crack initiation and crack growth periods as shown in Fig. 1. Crack initiation is mostly associated with cyclic plastic deformation which in turn is a function of stress raisers, sub-surface inclusion, gradient stress/strain field and environmental attack. Subsurface crack initiation has been observed primarily in many materials at very low stresses and very long lives, leading to the failure surface with the appearance of a fish-eye. Transition from surface-dominated fatigue processes to subsurface failure initiation is observed in the metals with primary inclusions. The difference in fatigue lives is significant between surface and sub-surface initiated modes of failure. Hence, the separation of experimental/analytical fatigue life data between surface and internal initiation failure modes is very important for several purposes, namely, tailored microstructural improvement at sensitive locations, repair, retrofitting and structural integrity assessment. The engineering fatigue crack initiation phase consists of three stages: crack nucleation, microstructurally and mechanically/physically short crack propagation [4,34]. Fig. 1 explains crack initiation period and the crack growth period until failure [5].

It is well known fact that the pipelines contain some defects during the manufacturing, installation and in-service. The significance of defects in the pipelines under various loading conditions is to be addressed properly for the design and safety assessment purposes. The pipelines are generally subjected to flexural fatigue loading due to which crack formation and growth will occur at defect/sensitive locations. The fatigue life of a pipe has two phases, namely, crack initiation and growth. Generally, crack spends about

* Corresponding author.
E-mail address: murthyarc@serc.res.in (A. Ramachandra Murthy).

https://doi.org/10.1016/j.net.2021.11.011
1738 5733/

9(2021-22)

Influence of AZ91 Alloy Reinforced with Nano B_4C particles on Microstructural Characterization, Hardness and Tribological Properties prepared Through Powder Metallurgy

C.Sankar[1], K.Gangatharan[1], S.Christopher Ezhil Singh[2], M.Sivaraj[3]

[1]Department of Mechanical Engineering, PSN College of Engineering and Technology, Tirunelveli, Tamilnadu, India.

[2]Department of Mechanical Engineering, Vimal Jyothi Engineering College, Kannur, Kerala, India.

[3]Faculty of Manufacturing, Department of Mechanical Engineering, Hawassa University, Hawassa, Ethiopia.

Abstract

In this present work, a milled B_4C nanoparticle was reinforced into the AZ91 alloy with different weight percentages (5, 10, 15, and 20 %) by powder metallurgy. XRD and SEM for the crystalline behavior and morphology of the AZ91-xB_4C composite. The wear resistance on the load and Sliding Distance (SD) of the specimen has been experimented with the pin-on-disc apparatus and Vickers hardness machine to measure hardness. Wear loss decreased gradually with the addition of milled B_4C nanoparticles is identified for AZ91-xB_4C nanocomposites. Coefficients of friction (COF) increased with an increase in load for AZ91-xB_4C nanocomposites. Microhardness was linear with the increase in the wt. % of milled B_4C nanoparticles. The worn surface micrograph was also studied using a scanning electron microscope.

Keywords: AZ91, milled B_4C nanoparticles, wear loss, Coefficient of friction, powder metallurgy.

1.0 Introduction

Over the past few years, the research on particulate reinforced metal matrix composite (PRMMC) owing to potential applications in the automobile, aerospace, electrical, and electronics industries. PRMMC can control grain size, increase load transfer effect, and has nucleation effect due to the thermal mismatch [1]. According to the earlier reporters [2], AZ91 is

Hindawi
Modelling and Simulation in Engineering
Volume 2022, Article ID 7129833, 9 pages
https://doi.org/10.1155/2022/7129833

Research Article

Performance Characterization of a Solar Cavity Collector Using Artificial Neural Network

B. Lakshmipathy,[1] **K. Sivakumar**,[1] **M. Senthilkumar**,[1] **A. Kajavali**,[1] **S. Christopher Ezhil Singh**,[2] **and Sivaraj Murugan**[3]

[1]*Department of Mechanical Engineering, Annamalai University, Annamalai Nagar, 608002, India*
[2]*Department of Mechanical Engineering, Vimal Jyothi Engineering College, Kannur, Kerala, India*
[3]*Faculty of Manufacturing, Department of Mechanical Engineering, Hawassa University, Hawassa, Ethiopia*

Correspondence should be addressed to Sivaraj Murugan; msivaraj2014@gmail.com

Received 19 September 2021; Revised 17 February 2022; Accepted 7 March 2022; Published 23 March 2022

Academic Editor: Houari Ameur

It is mandatory to improve the design of the flat plate collector (FPC) used for solar thermal applications to perform well. One way to improve the performance characteristics of FPC is to retain the heat energy available inside the collector. That is, a collector should be capable to give more heat energy to working fluid for a longer duration. It has been implemented in such a way in an entertained and improved model which is known as solar cavity collector (SCC). It consists of 5 numbers of cavities equipped with inlet and outlet tubes. The same having with an enclosure has been constructed and investigated to find the optimal performance. In general, the physical dimensions of the collector influence more the functioning behaviors of SCC. The performance variables that are considered for the present study are the comparison between 5 and 7 numbers of cavities and the effect of aperture entry. Collector angle of tilt, two types of flow mode, and water mass flow rates are the other performance variables that are also considered. The data from the experimentations are trained, tested, and validated with the help of the artificial neural network (ANN). The accuracy of the model is 96%, and the end results revealed the same trend followed by both experimental and ANN simulation results. Also, the variations that occur between ANN and experimented results are ±4%.

1. Introduction

For general home and industrial heating utilization, the heat energy needed is more to fulfill the requirements. If the desired temperature has achieving means, the heat is transferred to any kind of heat transfer fluid (HTF). The heating can be achieved by any kind of collection method that is available with specific requirements. Flesch et al. [1] have numerically analyzed the effect of angle of tilt at 0° to 90° cavity position and heat losses with the wind blowing on the cavity applied for cavity receivers. Also, they explain the effects of wind with these positions and how the huge impact on heat losses occurs in the particular environment. The cavity receivers designed with aperture transparent covering and reduction methods of convection losses have been analyzed and compared by Uhlig et al. [2]. Also, they analyzed the methods for enhancing collector efficiency. They conclude that the convection and radiation losses are decided by receiver tilt angle, the area of the aperture which is visible to the sun, and the temperature of the cavity receiver. The central receiver technology with low cost and high-performance scenarios has been reviewed by Zhu and Libby [3]. They discuss the thermal storage combined with the central receiver and its design considerations. It operates at higher temperatures and also delivers higher efficiency power generation and a cost-effective approach.

Samanes and Garcia-Barberena [4] have developed a transient simulation model numerically. The developed model was used to simulate the solar cavity receivers. They analyzed the performance-influencing parameters considering all major heat loss mechanisms in the cavity. For finding the thermal behavior, heat transfer fluid was utilized in

Signature Not Verified
Principal.VJEC

11(2021-22)

Journal of Applied Research and Technology

www.jart.icat.unam.mx

ICAT Instituto de Ciencias Aplicadas y Tecnología

Journal of Applied Research and Technology 19 (2021) 184-193

Original

Sport-utility vehicle prediction based on machine learning approach

G. Geetharamani[a] • K. Dhinakaran[b*] • Janarthanan Selvaraj[b] • S. Christopher Ezhil Singh[c]

[a]*Department of Mathematics, Anna University, Tiruchirappalli, India*
[b]*Department of Computer Science and Engineering, M.N.M. Jain Engineering College, Chennai, India*
[c]*Department of Mechanical Engineering, Vimal Jyothi Engineering College, Chemperi, Kannur, Kerala*

Received 11 07 2019; accepted 02 15 2021
Available 06 30 2021

Abstract: Data mining and machine learning analytics in manufacturing field is one of the major research fields in Information Technology with a lot of challenges. The goal of this research is to design a categorical solution to decide whether a customer is eligible and interested to purchase a sport-utility vehicle (SUV) based on the available data from the previous records collected from the banks. The data from different customers across various ages who have purchased the sport-utility vehicle earlier are collected and used in building a solution for this logistic model. A range of age and an estimated salary across different ages are the dependent factors in building this model. In addition, this model will predict the binary logistic outcome to show whether a customer can purchase a sport-utility vehicle or not. By enhanced cloud platform with larger volume of data keeping the algorithm remains the same using machine learning deployment for predicting the customer mindset in purchasing a sport-utility vehicle.

Keywords: Data mining, machine learning, prediction, classification, logistic regression, scikit-learn

*Corresponding author.
E-mail address: dhina79@gmail.com (K. Dhinakaran).
Peer Review under the responsibility of Universidad Nacional Autónoma de México.

Signature Not Verified

Principal.VJEC

Hindawi
Advances in Civil Engineering
Volume 2021, Article ID 6733402, 12 pages
https://doi.org/10.1155/2021/6733402

Research Article

Flexural Behaviour of RC Beams with a Circular Opening at the Flexural Zone and Shear Zone Strengthened Using Steel Plates

J. Branesh Robert,[1] **R. Angeline Prabhavathy**,[1] **P. S. Joanna**,[1] **S. Christopher Ezhil Singh**,[2] **Sivaraj Murugan**,[3] **S. Rajkumar**,[3] **and Shubham Sharma**[4]

[1]*Department of Civil Engineering, Hindustan Institute of Technology and Science, Padur, Chennai, Tamil Nadu 603103, India*
[2]*Department of Mechanical Engineering, Vimal Jyothi Engineering College, Kannur, Kerala 670632, India*
[3]*Department of Mechanical Engineering, Faculty of Manufacturing, Hawassa University, Hawassa, Ethiopia*
[4]*Department of Mechanical Engineering, IK Gujral Punjab Technical University, Main Campus, Kapurthala 144603, India*

Correspondence should be addressed to Sivaraj Murugan; msivaraj2014@gmail.com

Received 6 July 2021; Revised 29 September 2021; Accepted 8 October 2021; Published 2 December 2021

Academic Editor: Wenjie Ge

In this paper, an investigation on the behaviour of RC beams with circular openings in the flexural zone and shear zone strengthened using steel plates is presented. Totally seven beams were cast: a control beam, one beam with a circular opening of size of one-third the depth of the beam (100 mmϕ) in the flexural zone, one beam with opening strengthened using the steel plate, one beam with a circular opening of size of 100 mmϕ in the shear zone, one beam with an opening in the shear zone strengthened using the steel plate, one beam with two circular openings of size of 100 mmϕ in the shear zone, and another beam with two openings in the shear zone strengthened using the steel plate. The experiments were conducted in a loading frame of 400 kN capacity. The beams were subjected to two-point loading. The ultimate load carrying capacity reduced marginally by 1.78% and 2.8% compared to that of the control beam when a circular opening of 100 mmϕ was provided in the flexural zone and shear zone, respectively, and when the opening was strengthened with steel plates, it reduced by 3.04% and 25%, respectively, but the ductility increased when steel plates were provided. Beams with an opening of size of one-third the depth of the beam (100 mmϕ) in the flexural zone strengthened with the steel plate can be provided, as the load carrying capacity is only marginally reduced compared to the control beam, and the ductility is more when compared with beams with unstrengthened openings.

1. Introduction

In high-rise framed structures, providing service ducts is necessary for various purposes. If the ducts placed under the beams are covered by a false ceiling, the height of each floor increases, resulting in a considerable increase of the total height. The service ducts are provided through openings in RC beams. As a result, the stiffness decreases, which reduces the load carrying capacity and causes excessive deflection under the service load. Many researchers have studied the strengthening of RC beam with openings which increased the load capacity effectively. In order to enhance the shear capacity and regain the strength of the beams with openings, numerous strengthening techniques were suggested. FRP can play a key part in reinforcing and strengthening the structures. The reinforced concrete beams with openings can be strengthened by CFRP sheets, GFRP sheets, laminates, rods, fabrics, and so forth with different strengthening schemes. The load carrying capacity of the reinforced concrete beams with openings increases when strengthened externally with CFRP sheets in RC T-section deep beams [1], fibre reinforced polymer sheets in RC beams [2], unidirectional CFRP fabrics in RC T-beams [3], and NSM (near surface mounted) GFRP rods saturated with epoxy in RC self-compacting concrete deep beams [4]. CFRP laminates fully wrapped around the openings in RC beams with large openings [5], CFRP and GFRP sheets both around and inside the opening [6], CFRP strips with different

Signature Not Verified
Principal.VJEC

13(2021-22)

52 *Int. J. Rapid Manufacturing, Vol. 10, No. 1, 2021*

Investigation on mechanical properties for PolyJet-printed parts involving material reduction strategy

Arivazhagan Pugalendhi*,
Rajesh Ranganathan, M.P. Sreekanth and
Sivakumar Ganesan

Department of Mechanical Engineering,
Coimbatore Institute of Technology,
Civil Aerodrome Post, Coimbatore,
TN, 641014, India
Email: arivazhagan.mech02@gmail.com
Email: drrajeshranganathan@gmail.com
Email: smpcadd@gmail.com
Email: sivamechs@gmail.com
*Corresponding author

Abstract: Additive manufacturing (AM), a tool less manufacturing process has the advantage of saving material; however, this is not a wastage free manufacturing technology. In PolyJet technology, material wastage is more due to material replacement. This study concentrates on finding a solution to reduce the wastage of material and compare the mechanical properties of PolyJet-printed specimens in single-material (SM) mode and digital-material (DM) mode. In order to reduce the wastage, modified mixed tray strategy is proposed and it is validated by case example. Six different combinations of test specimens are derived from available three printing modes and two finish types of Objet260 Connex PolyJet. This research identified that the proposed technique is capable of saving material. Findings indicate that specimens printed by DM mode explicate low mechanical strength than SM mode. This study provides the awareness of the material replacement and increase the fidelity of the PolyJet-printed parts.

Keywords: additive manufacturing; PolyJet; Objet260 connex; material reduction; material replacement; flushing; modified mixed tray.

Reference to this paper should be made as follows: Pugalendhi, A., Ranganathan, R., Sreekanth, M.P. and Ganesan, S. (2021) 'Investigation on mechanical properties for PolyJet-printed parts involving material reduction strategy', *Int. J. Rapid Manufacturing*, Vol. 10, No. 1, pp.52–68.

Biographical notes: Arivazhagan Pugalendhi is currently working as Project Manager in Centre of Excellence in Manufacturing Sciences (funded by MHRD, Government of India) functioning at Coimbatore Institute of Technology. He completed his under graduation in Mechanical Engineering and received his Masters in Production Engineering. Currently, he is pursuing his PhD program under Anna University, Chennai. Apart from academic, he holds an industrial experience in the areas of mechanical design field like pattern and die making, special purpose machine. His research interests include additive manufacturing, new product development, product customisation, digital product manufacturing and healthcare innovations.

Signature Not Verified

Principal.VJEC

14(2021-22)

https://doi.org/10.36375/prepare_u.iei.a149

Preliminary Prototype and Analysis of a Customized Handle for Winding Machine using Fused Filament Fabrication

Sreekanth M P
Assistant Professor, Department of Mechanical Engineering
Vimal Jyothi Engineering College, Chemperi, Kannur, Kerala, India – 670632

{Corresponding author's email: smpcadd@gmail.com}

Abstract – Additive manufacturing transformed the prospect of product development. Customized and individualized product development never be so effortless. In this context, aim here is to develop a preliminary prototype of customized handle for winding machine using in handloom industry. Design of the handle is completed according to the hand anthropometric data of workers. CATIA V5R20 is used for 3D modeling and Analysis. Polylactic Acid (PLA) used as material and FlashForge Dreamer Additive Manufacturing (AM) machine, which works based Fused Filament Fabrication (FFF) is employed for prototyping. Analysis confirms that the design using PLA material is safe as maximum von Moses stress obtained (6.57 x 10^4 N/m²) is less than the yield strength of PLA material (4.9 x 10^7 N/m²).

Keywords - Prototype; Customization; Fused Filament Fabrication, Handle, Hand Anthropometry, Additive Manufacturing.

INTRODUCTION

By eliminating tool and reducing wastage of material, Additive Manufacturing (AM) or 3D Printing (3DP) can be considered as one of the most noteworthy development in manufacturing in recent years, which directly prints from Computer Aided Design (CAD) data layer – by – layer [1]. It helps the technology to be a potential player in Industry 4.0 [2]. Fused Filament Fabrication (FFF) or Fused Deposition Modeling (FDM) is an AM technology which usually fabricate the objects layer-by-layer by extruding material through a nozzle [3, 4]. FFF parts can be used in wide variety of applications from unarmed aerial vehicles to 3D Printers [5].

Parry et al. developed a customized crutch grip using 3D scanner, Autodesk Fusion 360, and Stereolithography (SLA) additive manufacturing and recommended that AM is a worthwhile method for fabricating customized Daily Living Aids (DLA) [6]. Additionally, using reverse engineering and FDM additive manufacturing technology, a customized helmet is developed with enhanced comfort. The researchers concluded from the study that the method is suitable for rapid product development and to address the needs of the customer individually [7].

A customized hand orthosis is developed using 3D Scanner and FDM AM machine with a printing time of about 11 hours and lead time of about 1 day, which will be useful for patients [8]. In addition to this, individually customized wrist orthosis was designed using the 3D scanned data of a patient and fabricated by employing FDM technology with upper layer of the orthosis was made of ABS and inner layer was made using TPU (Thermoplastic Polyurethane) [9]. TPU has considerable elasticity and research proved that the flexible inner layer increases the comfort of user [9].

Furthermore, customized orthosis is fabricated using Autodesk Inventor 3D modeling software, 3D scanner, MeshLab software for creating an automated algorithm of 3D scan data, and Raise 3D Pro FDM AM machine [10]. The study concluded that Polylactic Acid (PLA) is strong when compared to other materials used such as Acrylonitrile Butadiene Styrene (ABS), High impact Polystyrene (HIPS), and Polyamide 12 (PA12 – nylon) [10]. Fabrication of customized prosthetic sockets for upper limbs using 3D scanner and FDM process proved the feasibility of fully functional products [11].

Textile industries facing a challenge to deliver more customized products and amalgamation of product, process, and supply chain designs is the feasible to achieve customization in textile industry [12, 13]. At the same time, Chatterjee and Ghosh believed that textile industry can utilize 3DP by exploring its unique capability of manufacturing customized products [14].

From above it can be understood that the research explored the possibility of customized products in various areas including textile

Signature Not Verified

Principal.VJEC