Experimental Analysis of Automatically Manufactured Chain Link Fencing Wire

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Abstract- *Fences can be defined as arrangement that provides an obstruction, enclosure, or a boundary, made up of posts or stakes linked together by boards, wire, or rails. The chains run vertically and are bent into a zigzag pattern so that each "zig" hooks with the wire immediately on one side and each "zag" with the wire immediately on the other. The manufacturing of chain-link fencing is called weaving. A metal wire, frequently galvanized to reduce corrosion, is pulled along a rotating long and flat blade, thus making a somewhat flattened spiral. The spiral continuously rotate passing the blade and winds its way through the previous spiral that is part of the produced fence. When the spiral reaches the distant end of the fence, the spiral is cut near the blade. Then the spiral is pressed flat and the whole fence is moved up, ready for the next cycle. The end of each second spiral joins the end of each first spiral. The machine clamps both ends and gives them a few twists. This makes the links permanent. In this attempt of Experimental analysis of automatically manufacture chain link fencing wire is done. Here tensile test of Plain and Fenced wire is done for analysing effect of tensile strength on wires.*

Keywords- Fencing, Galvanised wire, wire mesh, Automatic chain link.

I. INTRODUCTION

A fence is a arrangement that encircles a space, typically exterior, and is usually created from posts that are connected by panels, wire, railings or mesh. A fence varies from a wall is not having a rock-solid foundation along its entire span. A chain-link fences usually made from galvanized steel wire. The manufacturing of chain-link fencing is called weaving. A metal wire frequently galvanized to reduce corrosion, is pulled along a rotating long and flat blade, thus making a somewhat flattened spiral. The spiral continuously rotate passing the blade and winds it through the previous spiral that is part of the produced fence. When the spiral reaches the distant end of the fence, the spiral is cut near the blade. Then the spiral is pressed flat and the whole fence is moved up and ready for the next cycle. The end of each second spiral joins the end of each first spiral. The machine clamps both ends and gives them a few twists. This makes the links permanent.

An enhanced version of the weaving machine winds two wires around the blade at once, thus creating a double helix. One of the spirals is woven through the last spiral that is part of the already produced fence. This progress allows the process to advance twice as fast.

Fig.1-Fencing.

II. LITERATURE REVIEW

D. Pons, G. Bayley, R. Laurenson, M. Hunt, C. Tyree, D. Aitchison carried out research on “Wire Fencing: Determinants of Wire Quality” in this they studied about Knotted wire fences which are fabricated on specialised machines. The input material is typically galvanised steel wire. However, the quality of the input wire used by the Fence Producer is beyond control of the Machine Manufacturer. In this problem is that wire strand breakages have been identified during fabrication and subsequent field erection.[1]

DirkJ.Pons,GarethBayley,ChristopherTyree,Matthew Hunt,andReubenLaurenson Aitchison carried out research on “Material Properties of Wire for the Fabrication of Knotted Fences” in this they studied about the materials properties of galvanised fencing wire, as used in the fabrication of knotted wire fences. A range of physical properties was inspected: tensile strength, ductility in tension, Young’s modulus, three point bending, and bending span.[2]

Sebastian Balos , Vencislav Grabulov, Leposava Sidjanin, Mladen Pantic carried out research on “wire fence as applique armour”in this they studied about the behaviour of wire fence. In this wire fences used was made from commercial high-strength patented wire and the supporting frames were made of mild steel L-profile were tested.[3]

Nurudeen A. Raji, Oluleke O. Oluwole carried out research on “Influence of Degree of Cold-Drawing on the Mechanical Properties of Low Carbon Steel”in this they studied about the Influence of Degree of Cold-Drawing on the Mechanical Properties of Low Carbon Steel. A 0.12%w C steel wire cold drawn progressively by 20%, 25%, 40% and 50% was checked. The influence of the degree of cold drawing on the mechanical properties of the carbon steel material were studied using the tensile test, impact test and hardness test experiments in order to replicate the service condition of the nails.[4]

Arshpreet Singh, Anupam Agrawal was studied about Comparison of deforming forces, residual stresses and geometrical accuracy of deformation machining with conventional bending and forming in this they studied about the Deformation machining. Deformation machining is a combination of thin structure machining and single point incremental form-ing/bending.[5]

Junichiro Tokutomia,, Kenichi Hanazaki, Nobuhiro Tsuji , Jun Yanagimoto carried out research on Change in mechanical properties of fine copper wire manufactured by continuous rotary draw bending process in this they studied about The mechanical behaviours of Cu–Sn alloy wire specimens processed by the newly proposed method of rotary draw bending are systematically investigated, It was found that during draw bending, the Vicker hardness(HV) was lower than that of the specimen subjected to wire drawing, particularly on the inside of the bend, and it was confirmed that the softening induced by plastic deformation is promoted by increasing the compressive residual energy.[6]

Christina Umstatter carried out research on “The evolution of virtual fences “in this they studied about virtual fences. A virtual fence can be defined as a structure serving as an enclosure, a barrier, or a boundary without a physical barrier.[7]

Siavash Rezazadeh and Jonathan W. Hurst carried out research on the Optimal Selection of Motors and Transmissions for Electromechanical and Robotic Systems With regard to the important role of motors and transmissions in the performance of electromechanical and robotic systems, this paper intends to provide a solution for the problem of selection of these components for a general load case.[8]

III. OBJECTIVE

Experimental analysis of automatically manufactured Chain link fencing wire.

IV. EXPERIMENTATION

Experimentation is done by conducting tensile test on UTM.

Working of the Instrument:-

The required gauge length is set by adjusting the upper knife edges A scale is provided for this purpose. Hold the specimen in the upper and lower jaws of Tensile / Universal Testing Machine. Position the extensometer on the specimen. Position upper clamp to press upper knife edges on the specimen. The extensometer will be now fixed to the specimen by spring pressure. Set zero on both the dial gauges by zero adjusts screws Start loading the specimen and takes the reading of load on the machine at required elongation or the elongation at required load. Force setter accuracies mean of both the dial gauge readings should be taken as elongation. It is very important to note & follow the practice of removing the extensometer from the specimen before the specimen breaks otherwise the instrument will be totally damaged. As a safety, while testing the instrument may be kept hanging from a fixed support by a slightly loose thread.

Test Set Up-

Fig2-Test set up

Fig 3-Holding of Fenced Wire.

UTM Results for Plain Wire-

PARAMETER	UNIT	DIMENSION
Specimen Type	-	Round
Initial Diameter	mm	2.50
Final diameter	mm	0
Cross sectional area	mm^2	4.909
Original gauge length	mm	50
Final gauge length	mm	0
Pre-Load	%	0.100
Ultimate Load	KN	2.44
Ultimate Strength	N/mm^2	496.945

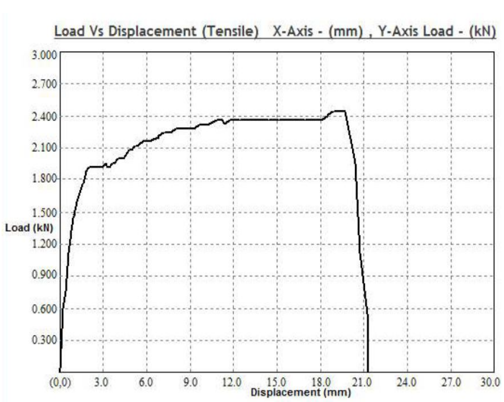

Fig 4-Graph of Load Vs Displacement of Plain Wire.

Graph shows that total deformation of plain wire is 21mm.

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Original gauge length	mm	50
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Pre-Load	%	0.100
Ultimate Load	KN	3.12
Ultimate Strength	N/mm^2	635.438

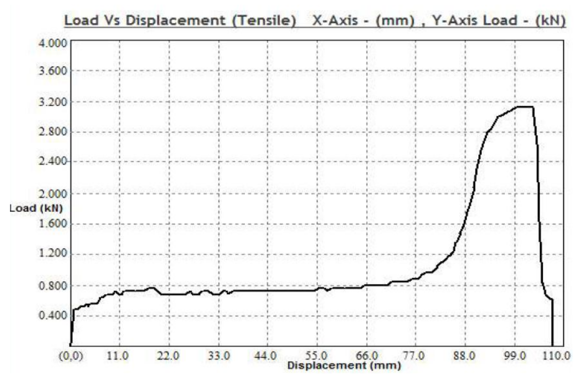

Fig 4-Graph of Load Vs Displacement of Fenced Wire.

Graph shows that total deformation of fenced wire is 110mm.

FEA Analysis of Plain and Fenced Wire-

FEA Analysis of Plain wire-

For Ultimate Load 2.44KN.

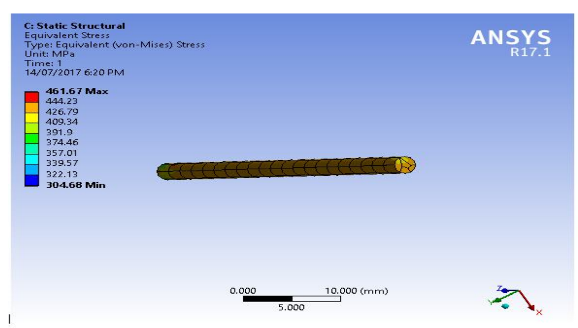

Fig 5-Equivalent Stress of Plain wire.

Ultimate Strength of plain wire=461.67 MPa.

Total Deformation of Plain wire-

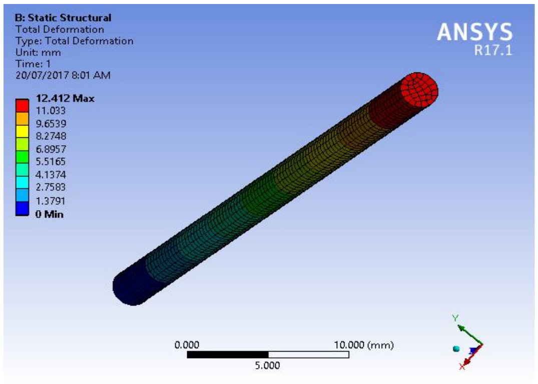

Fig 6-Total deformation of Plain wire.

Total Deformation of plain wire=12.41mm
FEA Analysis of Fenced Wire-
For Ultimate load-3.12KN.

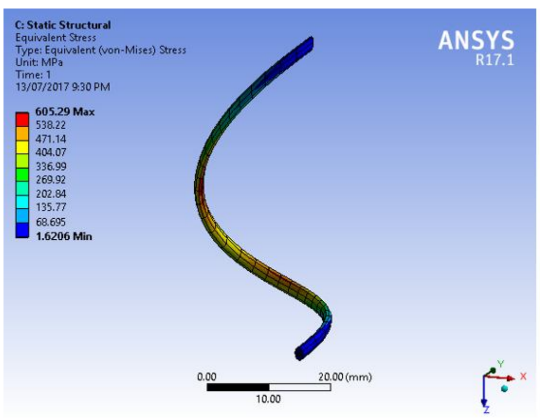

Fig 7-Equivalent Stress of Fenced wire.

Ultimate Strength of fenced wire=605.29 MPa.
Total Deformation of Fenced wire-

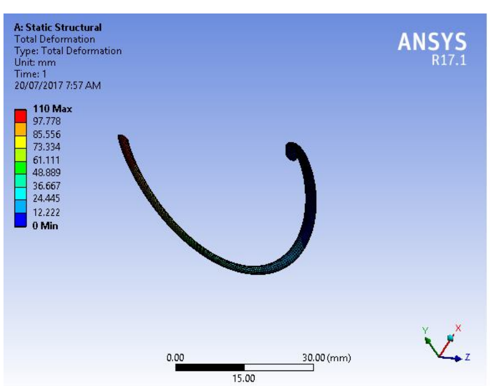

Fig 8-Total deformation of Fenced wire.

Total Deformation of plain wire=110mm.

V. RESULTS AND DISSCUSSION

Comparison between experimental and FEA Results.

Parameter	FEA Output Result	Experimental Output Result
Ultimate Strength For Plain Wire	461.67 N/mm^2	496.94 N/mm^2
UTS For Fenced Wire	605.29 N/mm^2	635.438 N/mm^2
Total Deformation of Plain wire	12.41mm	21mm
Total Deformation of Fenced wire	110 mm	110 mm

Above table shows that results obtained during UTM testing were nearly equal to FEA analysis results.

VI. CONCLUSION

Results obtained during UTM testing were nearly equal to FEA analysis result. Ultimate tensile test of Fenced wire is increases as compared to Plain wire. Ultimate tensile test of Fenced wire is increases due to Cold forming effect.

REFERENCES

[1] D. Pons*, G. Bayley, R. Laurenson, M. Hunt, C. Tyree, D. Aitchison “Wire Fencing (Part 1): Determinants of Wire Quality”, The Open Industrial and Manufacturing Engineering Journal, 5, 19-27, 2012,

[2] Dirk J. Pons, Gareth Bayley, Christopher Tyree, Matthew Hunt, and Reuben Laurenson,“Material Properties of Wire for the Fabrication of Knotted Fences”, Hindawi Publishing Corporation International Journal of Metals Volume 2014, Article ID 123195, 12 pages,2014.

[3] Sebastian Balos a, Vencislav Grabulov b, Leposava Sidjanin a, Mladen Pantic, “Wire fence as applique armour”, Materials and Design 31 (2010) 1293–130,2010.

[4] Nurudeen A. Raji, Oluleke O. Oluwole,“ Influence of Degree of Cold-Drawing on the Mechanical Properties of Low Carbon Steel”, Materials Sciences and Applications, 2011, 2, 1556-1563,2011.

[5] Arshpreet Singh, Anupam Agrawal “Comparison of deforming forces, residual stresses and geometricalaccuracy of deformation machining with conventional bending and forming”, Journal of Materials Processing Technology 234 (2016) 259–271,2016.

[6] Junichiro Tokutomia,c,∗, Kenichi Hanazakia,b, Nobuhiro Tsuji b, Jun Yanagimoto, “Change in mechanical

properties of fine copper wire manufactured by continuous rotary draw bending process", Journal of Materials Processing Technology 212 (2012) 2505–2513,2012.

[7] Christina Umstatter, "The evolution of virtual fences: A review", Computers and Electronics in Agriculture 75 (2011) 10–22,2011.

[8] Siavash Rezazadeh and Jonathan W. Hurst "On the Optimal Selection of Motors and Transmissions for Electromechanical and Robotic Systems".