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DESIGN AND ANALYSIS OF M.S ROLLER IN SHEET METAL ROLLING MACHINE

Vaibhav Bankar*, Pramod Vishwakarma
* Mechanical Engineering,VIT,Nagpur,India

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ABSTRACT

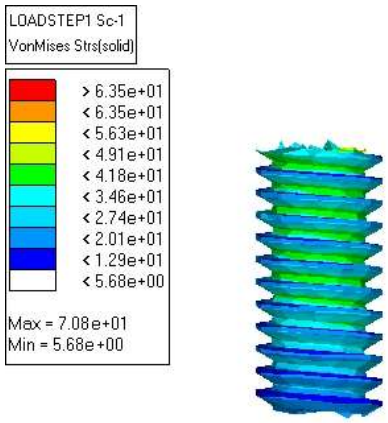
Metal forming can be defined as a process in which the desired size and shapes are obtained through plastic deformation of a material without any significance loss of material. Bending is a metal forming process in which straight length is transformed into a curved length. Roller forming is a continuous bending operation in which a long strip of metal is passed through consecutive sets of rollers, until the desired cross sectional profile is obtained. The roller bending process usually produces larger parts of cylindrical or conical cross sections in large quantity. Normal practice of the roller bending still heavily depends upon the experience and skill of the operator. In this project, the objective is to analyses the frictional wear on the end support of the roller and the lifting force on handle of the rolling machine which result in slip due to bending force.

KEYWORDS: Metal Forming, Deformation, Bending Force.

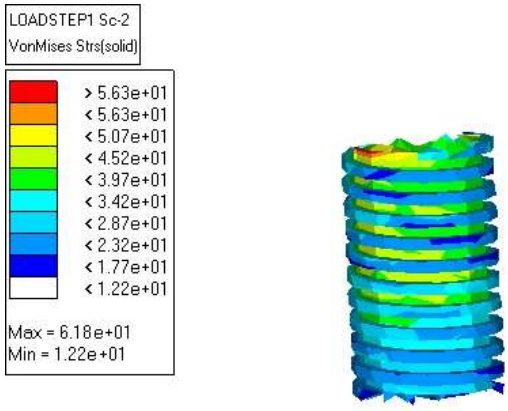
INTRODUCTION

Pro-tech Engineering Works is a company which is a manufacturer of equipment and machine for pharmaceutical chemicals, and food industries. The machine mostly includes octagonal blender, pressure vessel, heat exchanger etc. Sheet metal rolling operation which is cold rolling process is performed on the sheet for manufacturing of pressure vessel, heat exchanger. Sheet metal rolling machine is a job type production machine made as per requirement of customer which convert the flat sheet into required radius or curvature as per required of the diameter of pressure vessel or heat exchanger. The problem which is occurred in sheet metal rolling machine while performing the rolling operation in due to the stress induced in the threaded handle and support end of the rolling machine. The teeth on handle get wear and the diameter of the bore on the support end near the rolling bottom shaft increases due to frictional wear.

SOFTWARE RESULTS FOR THREAD CALCULATION



Buttress thread stress



Square thread stress

HAND CALCULATION TO FIND THE STRESS IN THE BUTTRESS THREAD

D=47 mm
d=40 mm
p=7
N=rpm
Rubbing speed;
r =R x w

$$= \frac{d}{2} \times \frac{\pi \times d}{30}$$

$$= \frac{40}{2} \times \frac{\pi \times 5}{30}$$

=10.486 mm/s
=0.0104m/s
Thus, Bearing pressure would be 20 mpa.

$$n = \frac{a}{p}$$

$$= \frac{55}{7}$$

$$=7.85 \approx 8$$

B =∏ x d x n
= ∏ x 40 x 7.85
=985.46
t =0.5 x p
=0.5 x 7
= 3.5

$$P_b = \frac{f}{t \times b}$$

$$20 = \frac{f}{3.5 \times 985.46}$$

f =20 x 3.5 x 985.46
f =69.12KN

BENDING STRESS

$$f_b = \frac{3 \times f \times t}{b\, h^2}$$

$$= \frac{3 \times 69.12 \times 3.5}{985.46 \times 3.5^2}$$

=65.20 N/mm^2

HAND CALCULATION TO FIND THE STRESS IN THE SQUARE THREAD

D=47mm
d=40mm
p=7
N=5rpm
Rubbing speed;

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r = R × w

$$= \frac{d}{2} \times \frac{\pi \times d}{30}$$

$$= \frac{40}{2} \times \frac{\pi \times 5}{30}$$

=10.486 mm/s

=0.0104m/s

Thus, Bearing pressure would be 20 mpa.

$$n = \frac{a}{p}$$

$$= \frac{57.5}{7} \quad = 8.79 \approx 9$$

B =∏ x d x n

= ∏ x 40 x 9

=1130.4

t =0.5 x p

= 0.5 x 7

= 3.5

$$P_b = \frac{f}{t \times b}$$

$$20 = \frac{f}{3.5 \times 1130.4}$$

f =20 x 3.5 x 1130.4

f =79.12KN

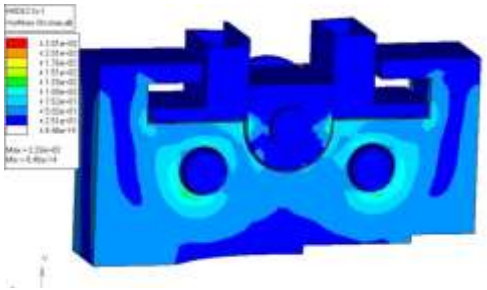
BENDING STRESS

$$f_b = \frac{3 \times f \times t}{b\, h^2}$$

$$= \frac{3 \times 79.12 \times 3.5}{1130.4 \times 3.5^2}$$

=56.86 N/mm^2

SOFTWARE RESULT FOR STRESS CALCULATION IN SUPPORT END



Stress at support end

HAND CALCULATION TO FIND THE STRESS IN THE SUPPORT END

$P = 1400\ N/mm^2$

$K_o = \frac{50 \times 49}{50 - 49}$

$= 2450$

$E = 200000$

$b = 2.15 \times \sqrt{\frac{P \times ko}{E}}$

$= 2.15 \times 4.14$

$= 8.28$

$6_c = 0.591\ \sqrt{\frac{P \times E}{Ko}}$

$= 0.591 \times 338.06$

$6_c = 199.79\ N/mm^2$

CONCLUSION

For Support End:-

Maximum von-misses stress generated in support end of sheet metal rolling machine is 226 MPA

High maintenance cost was incurred in rework of machine frame around the rollers. The region in the vicinity of the rollers failed due to high contact stresses, thus regular maintenance was carried out by adding material to the hole and then boring the hole to the correct dimensions. The solution to this problem was achieved by using the sleeves around the hole of very high grade steel (AISI4140) material whose strength is higher than the regular structural steel and thus it will be able to sustain the contact stresses for longer duration of time.

For Thread Design Of Handle:-

The screw threads that were used failed too often as the load applied through them was very high (75KN), so the thread were changed to square thread which has higher strength and performs better than the original V- thread.

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