A PROJECT REPORT

ON

MODELLING AND SIMULATION OF STEPPER FEEDER MECHANISM FOR PUNCH PRESS

Submitted by

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In partial fulfillment for the award of the Degree

Of

BACHELOR OF ENGINEERING

IN

MECHANICAL ENGINEERING

UNDER THE GUIDANCE

Of

Prof. RIZWAN SHAIKH

DEPARTMENT OF MECHANICAL ENGINEERING

ANJUMAN-I-ISLAM

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CERTIFICATE

This is to certify that the project entitled

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To the Kalsekar Technical Campus, New Panvel is a record of bonafide work carried out by him under our supervision and guidance, for partial fulfillment of the requirements for the award of the Degree of Bachelor of Engineering in Mechanical Engineering as prescribed by **University Of Mumbai**, is approved.

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APPROVAL OF DISSERTATION

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Date: __________

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After the completion of this work, we would like to give our sincere thanks to all those who helped us to reach our goal. It's a great pleasure and moment of immense satisfaction for us to express my profound gratitude to our guide **Prof. RIZWAN SHAIKH** whose constant encouragement enabled us to work enthusiastically. His perpetual motivation, patience and excellent expertise in discussion during progress of the project work have benefited us to an extent, which is beyond expression.

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Abstract

A common method of feeding the stock material into the press is bypassing it through a pair of feed rollers which apply friction to the material and rotate in a cooperative manner to feed the stock in to the punch press. By synchronizing the rotation of the feed rollers to the speed of the press,the stock material is fed in to the punch press at the proper rate.Stepping motors are widely used in robotics and in the numerical control of machine tools to perform high precision positioning operations.The principal object of this invention is to provide a strip stock feeding mechanism that is suitable for feeding any desired length of stock for each cycle and which may be very easily adjusted for various lengths of feed.It was found that cost of stepper feeder is quite less as compared to other types of feeder available in the market.

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Chapter 1

Introduction

1.1 Punch press

A **punch** used to cut holes in material and a **press** is a mechanism used for forcing die to penetrate into material. Although the punching of holes is often accomplished with die sets that also perform bending and forming, a punch press is designed specifically for the making of various shaped holes and cutouts on sheet metal and plate material. The punch press is fitted with punches and dies of the size and shape of the hole required. For irregular and non-standard holes, the modern punch press is capable of nibbling. This refers to a series of successive “hits” following a predetermined pattern that creates the cutout. The punching action is accomplished by a vertical moving ram that forces the punch through the material and into a die through which the resulting slug is ejected. Additionally, a device to hold the material in place as the punch is withdrawn, call a stripper, is often an integral part of the punch tool. The press ram may be activated manually, mechanically, or hydraulically. The manual press, usually a table top model, is capable of generating about four tons of force. Mechanical punch presses use a system of flywheels, gears, and eccentrics to stroke the ram. Hydraulic presses use oil pressure to perform the punching action. These last two types can generate from 8 to 60 tons of force with some larger models creating over 150 tons. Mechanical presses can operate faster than hydraulic models but the latter can exert more punching pressure more uniformly on the thicker work piece. Press Capacity is determined by not only available tonnage, but also by effective throat depth. This determines how large a work piece the press can accommodate. Throat depth is measured from the center of the punching tool to the rear of the press. Other capacities are the movement of the carriage on which the work is mounted and the weight of the work piece. A press may have a single tool mounting station or multiple stations mounted in a revolving turret. Very heavy punching in plate structure is done in the “iron worker.” These perform cutting and parting in addition to punching. Turret punches can hold from 12 to 70 punch assemblies and can be rotated depending on the press type, manually or automatically with a CNC system. Tool changing can also be done in semi- and full automatic modes.

1.2 Hydraulic punch press

Hydraulic punch presses, which power the ram with a hydraulic cylinder rather than a flywheel, and are either valve controlled or valve and feedback controlled. Valve controlled machines usually allow a one stroke operation allowing the ram to stroke up and down when commanded. Controlled feedback systems allow the ram to be proportionally controlled to within fixed points as commanded. This allows greater control over the stroke of the ram, and increases punching rates as the ram no longer has to complete the traditional full stroke up and down but can operate within a very short window of stroke.

Figure 1.1.Hydraulic Punch Press

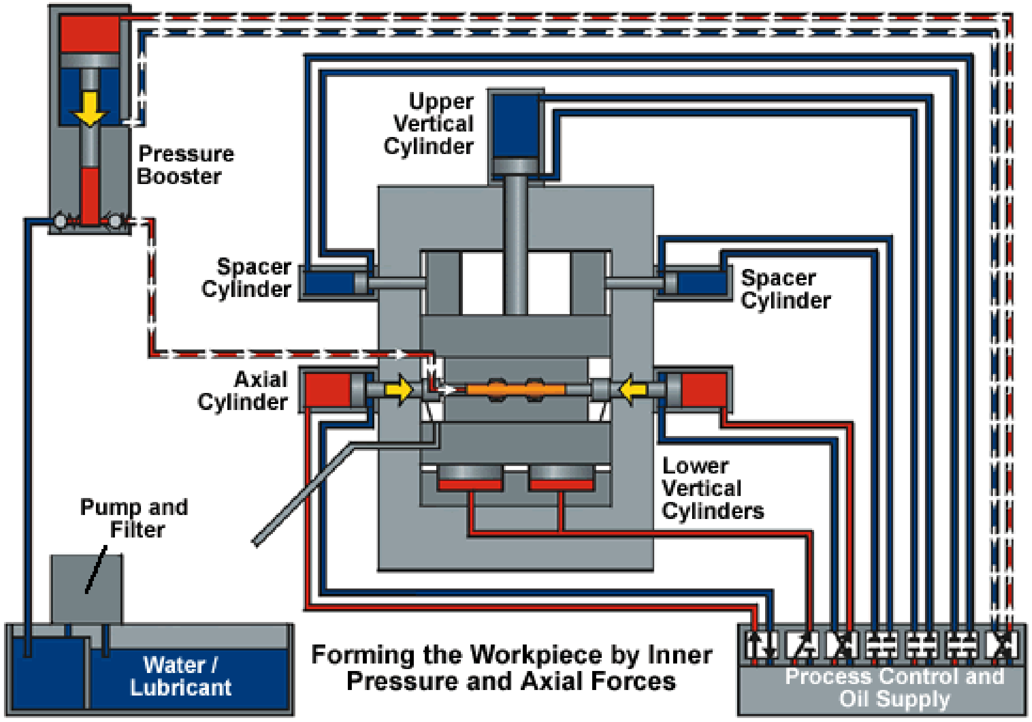

Figure 1.2.Layout of hydraulic punch press

1.3 Mechanical punch presses:

Mechanical punch presses fall into two distinct types, depending on the type of clutch or braking system with which they are equipped. Generally older presses are "full revolution" presses that require a full revolution of the crankshaft for them to come to a stop. This is because the braking mechanism depends on a set of raised keys or "dogs" to fall into matching slots to stop the ram. A full revolution clutch can only bring the ram to a stop at the same location- top dead center. Newer presses are often "part revolution" presses equipped with braking systems identical to the brakes on commercial trucks. When air is applied, a band-type brake expands and allows the crankshaft to revolve. When the stopping mechanism is applied the air is bled, causing the clutch to open and the braking system to close, stopping the ram in any part of its rotation.

Figure 1.3.Mechanical punch press

1.4 Servo drive turret punch press

A servo drive turret punch press uses twin AC servo drives directly coupled to the drive shaft. This drive system combines the simplicity of the original clutch and brake technology with the speed of a hydraulic ram driven system. This results in high performance, reliability, and lower operating costs. A servo drive press system has no complex hydraulics or oil-cooling chillers, thus reducing maintenance and repair costs. Smaller size electric drive motor that will have a lighter and lower inertia armature which in turn further reduces the overall amount of rotational inertia of the roll feeder system.

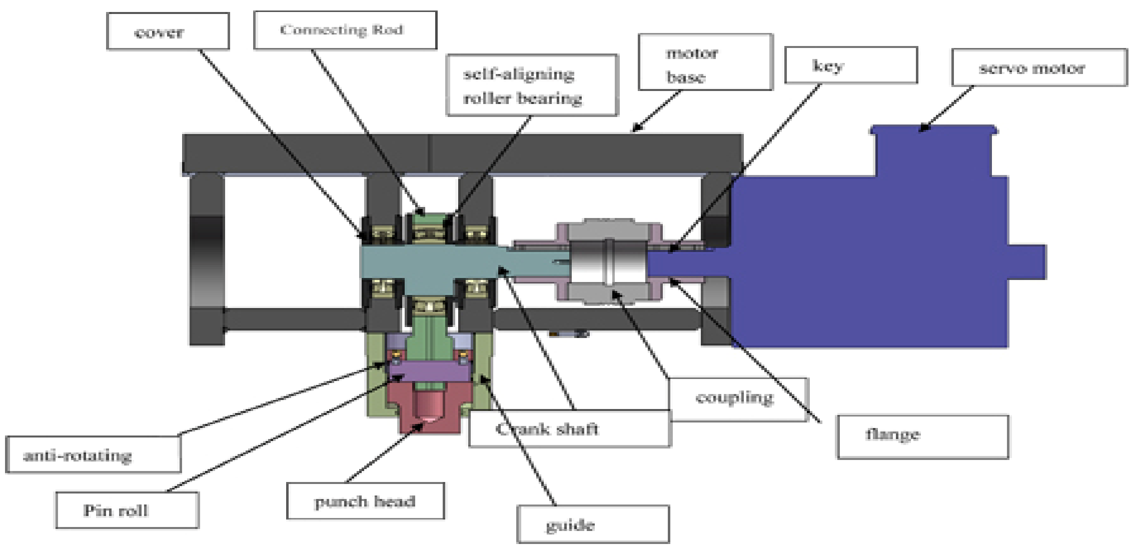

Figure 1.4.Servo turret punch press

1.5 Feeder mechanism:

Punch press bore works in downward stroke and remains idle in upward stroke. So, it is necessary to feed stock material into punch press with stepwise manner as well as with precise timing.

Following are the different types of feeder mechanism used:

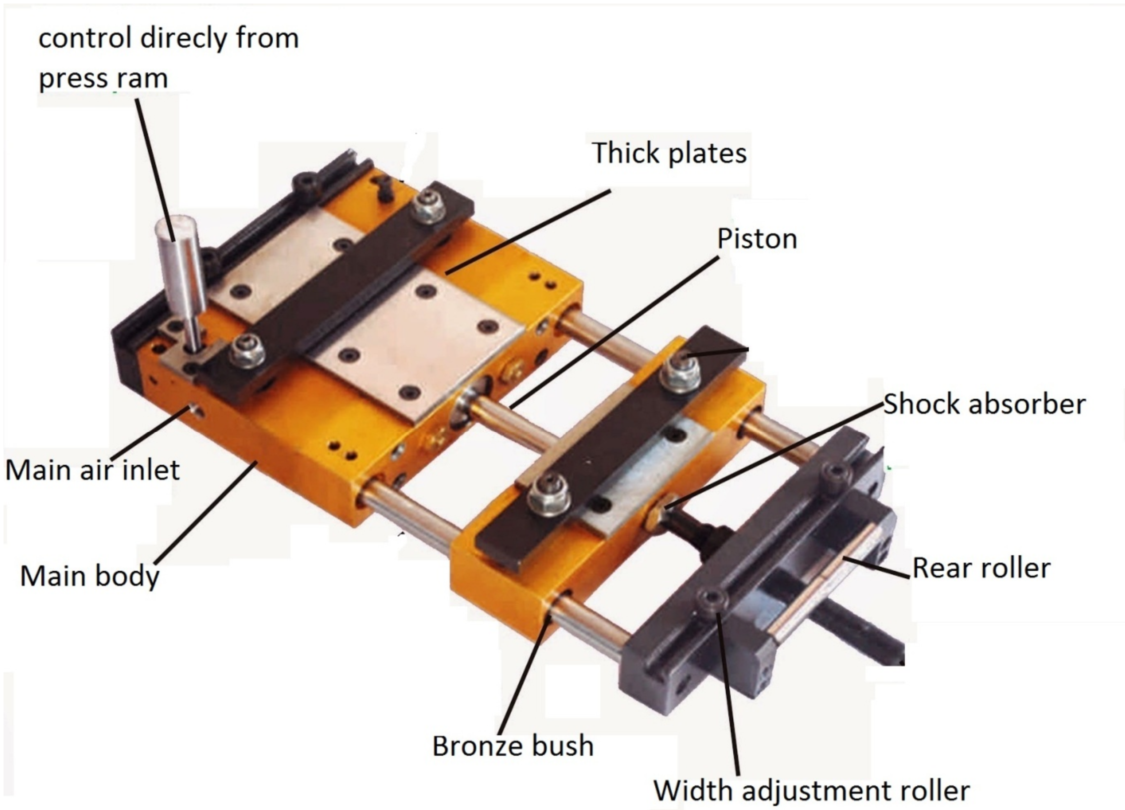

Figure 1.5.pneumatic feeder

1.6 Pneumatic feeder difficulty:

• Requires installation of air-producing equipment.

Compressed air should be well prepared to meet the requirements. Meet certain criteria, such as dry, clean, and contain the necessary lubricant for pneumatic equipment. Therefore require installation of pneumatic systems is relatively expensive equipment, such as compressors, air filter, lube tube, dryer, regulators, etc.

• Easy to leak

One of the properties of pressurized air is like to always occupy the empty space and the air pressure is maintained in hard work. Therefore we need a seal so that air does not leak. Seal leakage can cause energy loss. Pneumatic equipment should be equipped with airtight equipment that compressed air leaks in the system can be minimized.

• Potential noise

Pneumatic using open system, meaning that the air that has been used will be thrown out of the system, the air comes out pretty loud and noisy so will cause noise, especially on the exhaust tract. The fix is to put a silencer on each dump line.

• Easy condenses

Pressurized air is easily condensed, so before entering the system must be processed first in order to meet certain requirements, such as dry, have enough pressure, and contains a small amount of lubricant to reduce friction in the valves and actuators.

- **Control and Speed-** Air is a compressible gas, which makes control and speed in a pneumatic system more difficult, in comparison to electric or hydraulic systems. When specific speeds are needed, additional devices have to be attached to the pneumatic system in order to procure the desired result.

- **Safety:** Pipes that feed the system air have the ability to move on uncontrollably on their own, which could cause serious injuries to those nearby.

- **Loudness**: Pneumatic systems are the loudest type of designs that power machines. Actuators that run the system are the source of the noise and are sometimes placed in a separate room to limit sound pollution.

1.7 Hydraulic feeder difficulty

- Efficiency of a volumetric hydraulic feeder is a little bit lower, than efficiency of mechanical and electric transfers, and during regulation it is reduced.
- Conditions of operation of a hydraulic feeder (temperature) influence its characteristics.
- Efficiency of a hydraulic feeder is a little reduced in the process of exhaustion of its resource owing to the increase in backlashes and the increase of outflow of liquid (falling of volumetric efficiency).
- Due to the heavy loads experienced in a typical hydraulic system, structural integrity is a must.

- Hydraulic system is susceptible to contamination & foreign object damage.

- **Filters**: You must filter oils in hydraulic systems on a regular basis to ensure that the hydraulic fluid contains no broken particles, as well as to eliminate harmful damaging air pockets.
- **Leaks:** Hydraulic systems that do not have the necessary hydraulic fluids will not function, which becomes a problem when a leak occurs. Fortunately, areas that have leakage will also have hotter internal temperatures, according to Insider Secrets to Hydraulics.

- **Aeration:** Hydraulic systems can develop loud banging noises, which result from air entering the hydraulic fluids. This banging noise results from the hydraulic fluids compressing and decompressing, according to Machinery Lubrication. This dynamic can also cause foaming, erratic actuator movements, degradation of the hydraulic fluid and damage to the internal parts of the hydraulic system.

1.8 Problem Definition

The traditional pneumatic and hydraulic feeders face following problems:

- Errors in feed length occur due to variations in air pressure and flows.
- Dust and moisture may incur in air lines.
- Each pneumatic feeder is specific for certain length and material thickness.
- No scope for manual error compensation.
- Noisy operations.

1.9Objective

- To increase the production rate by increasing speed of feeding mechanism.
- To feed plain metal strip by pressing it through roller while drawing it from stock of metal strip.
- To reduce the noise produced by earlier strip feeding mechanism (i.e. pneumatic and hydraulic feeder).
- To reduce vibration by using non vibratory feeder.
- To suggest a feeder mechanism which is adaptable for various punch presses with different speed as well as for different feed-length and material thickness.

Design of our work

Flow chart of the report

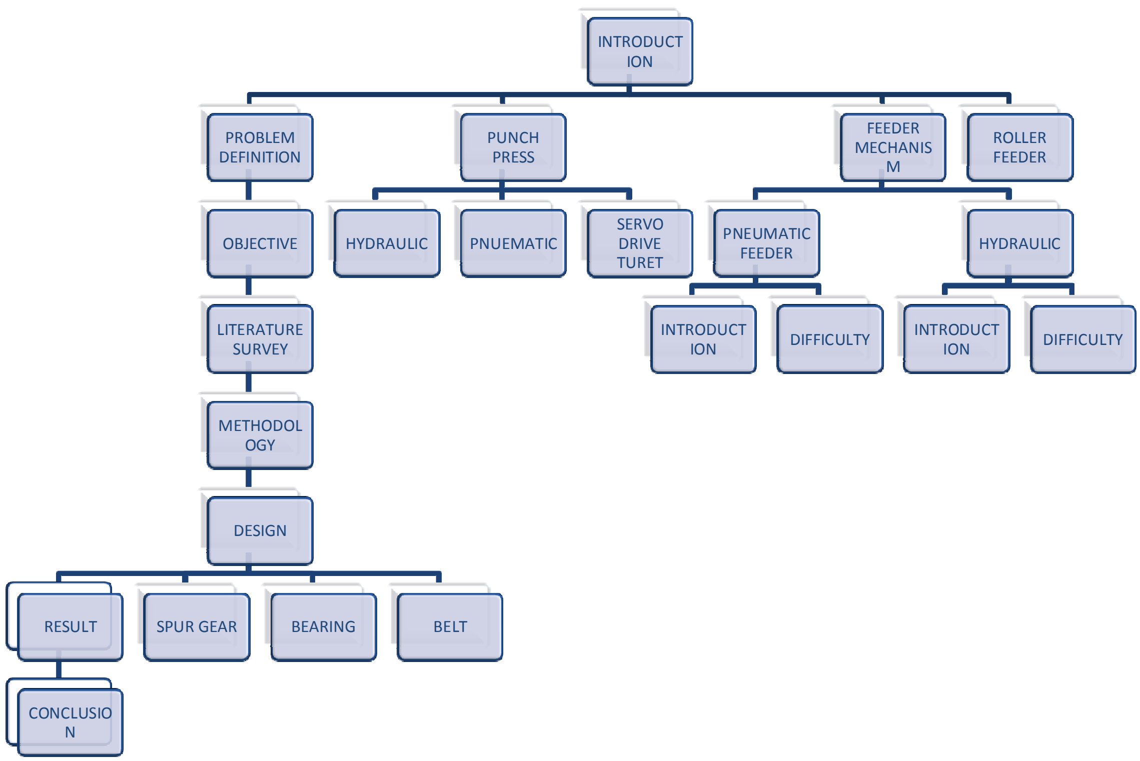

Figure 1.6.Flowchart of Design Work

Chapter 2

Review of literature

DEEP DRAWING WITH SUPERIMPOSED LOW-FREQUENCY VIBRATIONS ON SERVO-SCREW PRESSES (SEBASTIAN KRIECHENBAUER*, REINHARD MAUERMANN, PETER MULLER):The power train of a modern servo-screw press with low rotational moment of inertia provides higher dynamics and a new kind of flexibility in forming and stamping processes compared to conventional servo presses. In this paper a new technology for deep drawing on servo-screw presses called cushion-ram pulsation is described. It uses superimposed low-frequency vibrations between 10 Hz and 50 Hz at the cushion and the press ram. For deep drawing operations, the high tensile stresses in the frame of cylindrical cup usually lead to a reduction of material thickness. Thus, and due to the lack of work hardening, fractures frequently occur in the punch radius. The process developed here shifts critical loads to higher drawing ratios by decoupling the drawing operation and the prevention of wrinkles. A high frequency of the cushion-ram pulsation is necessary to allow high productivity. Technological results will be increasingly determined by the machine.

IDENTIFICATION OF FRICTION COEFFICIENT IN HIGH ASPECT RATIO COMBINED FORWARD-BACKWARD EXTRUSION WITH PULSE RAM MOTION ON SERVO PRESS (RYO MATSUMOTO*, KAZUNORI HAYASHI, HIROSHI UTSUNOMIYA):An extrusion method for forming deep holes is proposed with a servo press that utilizes a punch with an internal channel for the supply of liquid lubricant. In this forming method, the punch is pushed into the specimen with a servo press in a manner that combines pulsed and stepwise modes. Sufficient liquid lubricant is periodically supplied to the deformation zone through the internal channel upon the retreat of the punch. In this study, this forming method with pulse punch ram motion is applied to combined forward-backward extrusion process with a high aspect ratio. The coefficient of shear friction at the specimen–punch contact is identified by analyzing material flow of aluminum specimen during extrusion. The proposed forming method with appropriate pulse punch motion is confirmed to reduce the friction from the coefficient of shear friction of 0.4 to lower than 0.2.

DYNAMIC CHARACTERISTICS ANALYSIS AND EXPERIMENTAL VERIFICATION OF HIGH-SPEED PRECISION PUNCH PRESS BASED ON COUPLED THERMAL-MECHANICAL MODEL (FENGFENG HU, YU SUN*, BINBIN PENG SCHOOL OF MECHANICAL ENGINEERING, NANJING UNIVERSITY OF SCIENCE AND TECHNOLOGY, XIAOLINGWEI, NANJING, 210094, CHINA.): In order to analyze the impact load after collision of joints with clearance, dynamic model was established for a type of multi link high-speed precision punch press. We compared the load of joints under different dynamic models with clearance or not. Based on the material characteristic and load spectrum of joints with clearance, the models of heat production between joints were founded to calculate the heating power between joints affected by impact load. Moreover, to calculate actual operating temperature of the joints, the heat balance equation of joints was established according to the condition of lubricating and cooling. Lastly, we did experiments on testing the actual temperature of joints during working to check out whether the dynamical analysis and theoretical calculation of heat balance equation were correct or not.

MECHANICAL SERVO PRESS TECHNOLOGY FOR METAL FORMING (K. OSAKADA (1)A*, K. MORI (2)B, T. ALTAN (1)C, P. GROCHE (1)D):Recently several press builders developed gap and straight-sided metal forming presses that utilize the mechanical servo-drive technology. The mechanical servo-drive press offers the flexibility of a hydraulic press (infinite slide (ram) speed and position control, availability of press force at any slide position) with the speed, accuracy and reliability of a mechanical press. Servo drive presses have capabilities to improve process conditions and productivity in metal forming. This paper reviews the servo press designs, servo-motor and the related technologies, and introduces major applications in sheet metal forming and bulk metal forming.

ADAPTIVE PID CONTROL OF A STEPPER MOTOR DRIVING A FLEXIBLE ROTOR (NEHAL M. ELSODANY *, SOHAIR F. REZEKA, NOMAN A. MAHAREM): Stepping motors are widely used in robotics and in the numerical control of machine tools to perform high precision positioning operations. The classical closed-loop control of the stepper motor cannot respond properly to the system variations unless adaptive technique is used. In this paper, the feasibility of fuzzy gain scheduling control for stepping motor driving flexible rotor has been investigated and illustrated by numerical simulation. The proposed control was concerned with the permanent magnet step motor (PMSM) with mechanical variations such as stiffness of rotor and load inertia. A mathematical model for the PMSM was derived and the gains of a conventional PID control were presented. The data base required in learning process of the fuzzy logic gain scheduling mechanism was obtained from the mathematical model. It was found that the stable value for the integral gain is half the value of the proportional gain. The fuzzy systems for scheduling the derivative gain and the proportional gain are presented. The conducted simulation showed that the fuzzy system is able to adapt the controller gains to track the desired load and speed response. Fuzzy PID performance is much better than the conventional PID control scheme. Fuzzy self-tuning controller demonstrates a very fast response and little overshoot.

SHEET STAMPING FORMABILITY TEST SYSTEM BASED SERVO CRANK PRESS (YANGGEN CAO, XUELIN DU, YU SU, WANPENG DONG, PEIRAN DENG, QINCHAO RUAN): Proposed the tentative plan that carries on the formability test by simulation practical crank punch press slide speed characteristic, designed the solution to the implementation difficulty, and has carried on the actual attempt. The servo motor drive crank press speed alters at more sects which can get slider speed characteristic coherent with crank press varies. The system can test varies stamping formability that speed changeable based on sine curve. The system is composed of 600kN servo crank press, double action and all-purpose moldbase, date get and inspect analyze system. The mold base adopted positive direction structural and self-motion, with variable blank holder force and counterforce controlled by hydraulic system with closed loop. The blank holder force can be set up in 5 sects which following with slide position, shortest control sect in 200 ms. Appropriate profile of blank holder force can setup with the process needed. Blank holder has quartz force sensor which can inspect blank holder force and the control precision is in 0.1kN.

Chapter 3

Methodology

SOFTWARE USED:

There are many types of software available to model, simulate and analyze proposed mechanism .So, in order to get more satisfactory results following softwares are used:

- Solidworks (for modeling and simulating mechanism).
- Ansys (for analysis purpose).

3.1 Design procedure

- A stepper feeder mechanism consists of various components.
- The components which needed to be designed are:

1. Spur gear.
2. Bearing (Selection as per the manufacturer catalog).
3. Belt.

3.1.1 Design of spur gear

Given data: Torque (T)=m_t =25kg-cm

Gear ratio (i)=1

Teeth on pinion Z_1= 45teeth

RPM=5rpm

Step1: system selection and finding weaker element

a) Considering closed system and 20° full depth involute system
$Z_1+Z_2=90$
Gear ratio(i)=Z_2/Z_1 (PSG 8.12) table 7
Z_2=45 …………..(for angular positioning purpose)

b) Selection of material from (PSG 8.5)

Select	MATERIAL	σ_b (kgf/cm^2)	σ_c(kgf/cm^2)
Pinion	C45(EN8)	1400	5000
Gear	EN 24	1200	4500

c) According to the lewi's form factor from (PSG 8.50)
Yp = (0.154 - 0.912/Z_1)

= 0.4201

d) Strength calculation: σ_b×Yp = 1400×0.4201

= 588.18kgf/cm^2

Step2: Determination of module (m) from (PSG 8.13A)

m≥1.26Yp×[σ_b] × p×ψm×Z_1) from (PSG 8.14)

φ_m=b/m= 10

b = force width

σ_b= 1400kgf/cm

Z_1=45

Yp= 0.4201

m_t= 25kg-cm

[m_t]=m_t.k.kd= 25×1.3………(k.kd=1.3)

[m_t]= 32.5kgf-cm

m≥1.26$\sqrt{(0.4201 \times 1400 \times 10 \times 45)}$

m≥0.0626

m≥0.0626=1mm

Increasing this value by 20% to consider the radial load and direct shear load which was neglected by

By lewi's equation

m≥0.266mm

Therefore selecting the higher module from (PSG 8.2)

Module (m) =4 mm

Step3: Check for contact strength ($\sigma_c$induced) from (PSG 8.13)

σ_c= 0.74×(i+1/a)i+1/ib×E× $[m_t]$ $\leq \sigma_c$

Center distance (a) =m (Z1+Z2/2)

a = 4(90/2)= 180mm= 18cm

b= φ_m = 10×45= 40mm

b= 4cm

E=2.15×10^6kgf/cm2 from (PSG 8.4)

$[m_t]$= 32.5kgf-cm

σ_c= 0.74×(1+1/18)1+1/4×2.15×10^6× 32.5

= 485.99kgf/cm^2≤5000 kgf/cm^2

Therefore it is safe

Step4:1)Check for static strength (fs)

2)wear load (fw)

3)dynamic load (fd)

Dp=m.Z= 4×45 = 180

Vm=ΠDn/60

=(Π×40×5)/60

Vm =0.0471m/s

Power = torque ×speed

= mt× w

= mt×2Πn/60

= 2.5×2 ×∏ ×5/60)

= 1.308Nm/s

= 1.308watt

Ft= H.p×75/vmfrom(PSG 8.50)

$=(1.308\times75\times1.2/746\times0.0471)$

$Ft=3.35kgf$

$Fd = ft\times c.v$

$c.v= 3+vm/3$

$= 3+0.0471/3$

$= 1.015$

$Fd= 3.35\times1.015$

$Fd= 3.40kgf$

Wear load (fw)=$D.b.Q.k = 180\times4\times Q\times k$ from (PSG 8.51)

$Q= 2i/i+1= 2\times1/1+1 = 2$

$K=(\sigma c^2\sin(1/E_1+1/E_2)/1.4)$

$K=(5000^2\sin20(2/2.15\times10^6)/1.4)$

$K=5.68kgf/cm^2$

$Fw=180\times4\times1\times5.68$

$Fw= 4089.6kgf$

$Fw>fd$

Therefore it is safe

For static stength

$Fs= \sigma b\times m\times b\times Yp$

$= 1400\times0.4\times4\times0.420$

$Fs= 940.8kgf$

$Fs>fd$

Therefore it is safe

Step5: Constructional details

For pinion gear

pc=Π×m=Π×4 =12.56mm=1.256cm

r=0.55

=3.904

It is integral with safe

Step6:Gear parameter

Pitch circle diameter = m.z= 4×45=180mm

Module(m)=4mm

Teeth on pinion and gear =45

Face width(b)=40 mm

Center distance(a)=180 mm

Pressure angle()=20^0

Step7:Check for bending stress

σ_c=(i+1/a.m.b.Yp) $[m_t]$≤$[\sigma_c]$

σ_c=(1+1/18×0.4×4×0.4201)×32.5

=5.37kgf/cm^2>σ_b=1400kgf/cm^2

Therefore it is safe

Conclusion: Hence the design is safe.

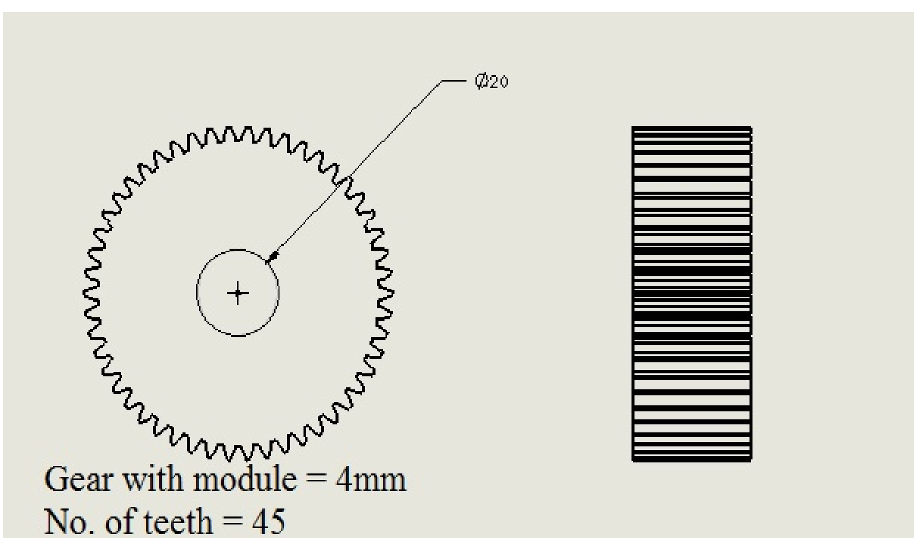

Figure 3.1.Design of Pinion

3.1.2Design of roller with arm:

In order to leave minimum clearance between two roller (for gripping stock material firmly) following references are taken.

Diameter of solid roller = pitch circle diameter of gear= 180 mm

And suitable arm diameter = 20 mm

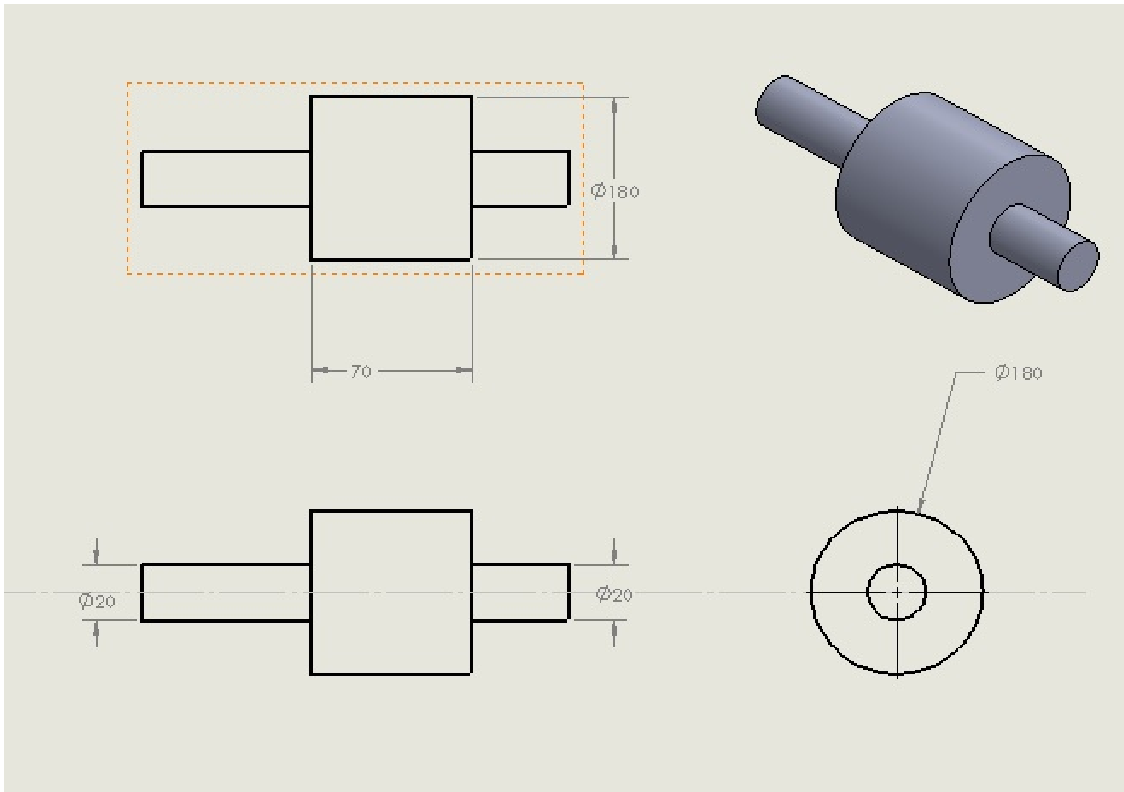

Figure 3.2. Design of roller

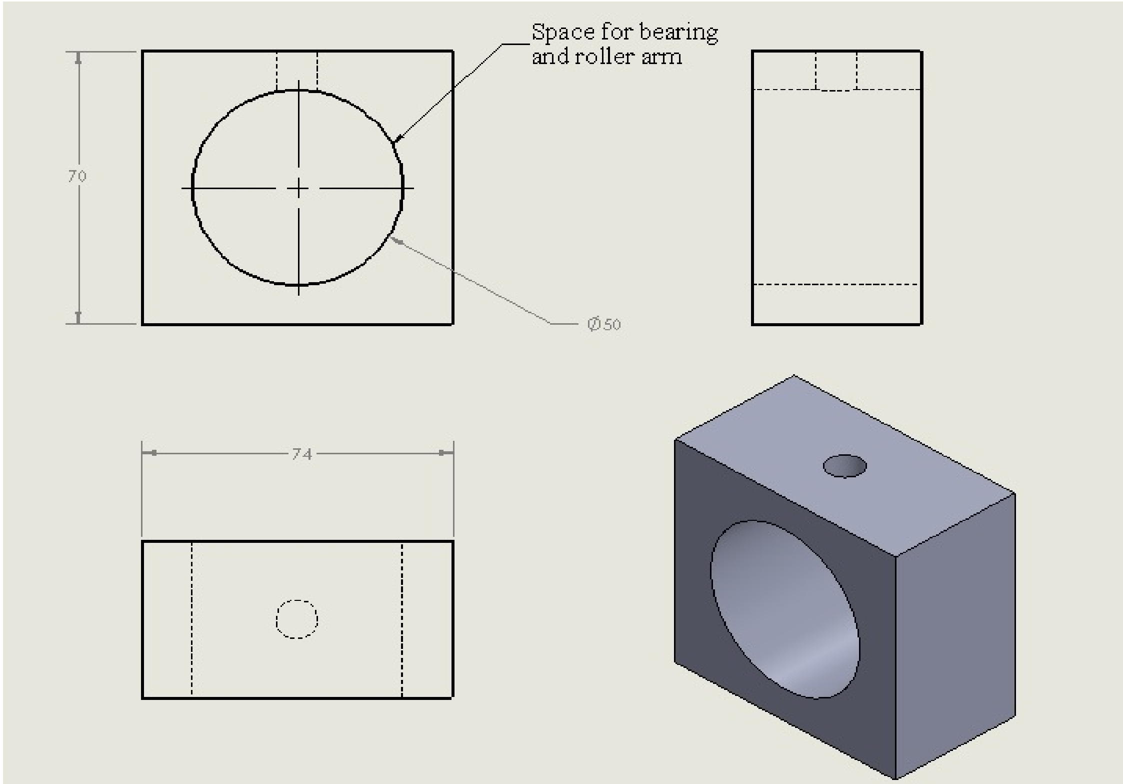

Figure 3.3.Slider

3.1.3 Design of bearing:

Gears of the Stepper feeder mechanism will rotate at maximum 5rpm, so any random bearing with id = 20 mm will be required and it is not necessary to check the bearing for safety since load and speed is very less. The bearing can be selected from catalog of manufacturer directly.

3.1.4 Design of belt and pulley:

Flat belt drive has following disadvantages:

1. Slip:
   When belt is running at optimum speed it may overcome kinetic coefficient of friction and slip may occur between belt and pulley.
2. Creep:
   If driving and driven pulleys are running at different speed creep may occur which may give rise to error

To overcome these disadvantages of the flat belt, hence timing belt and toothed pulley is selected.

Timing belt dimensions are derived from dimensions of toothed pulley, which can be decided simultaneously from manufacturer's catalog.

TIMING BELT SELECTION:

Necessary abbreviations:

do = pulley diameter.

d= pulley pitch diameter.

d= (p x Zp)/π   p= pitch

Z_0=pulley teeth(n_0)

u= pitch differential (standard for belt) by table

d_0=d-2u=(p.Zp/π)-2u

belt length and center distance

L=p.Z_b

Z_b= number of teeth on belt

L = measured along pitch line for two equal diameter pulley

L= 2C+π.d

C=center to center distance

d=pitch diameter

3.2 Material selected for accessories:

Table1.material selection

Part	**Material**
Roller	EN8
Vertical plate	Mild steel

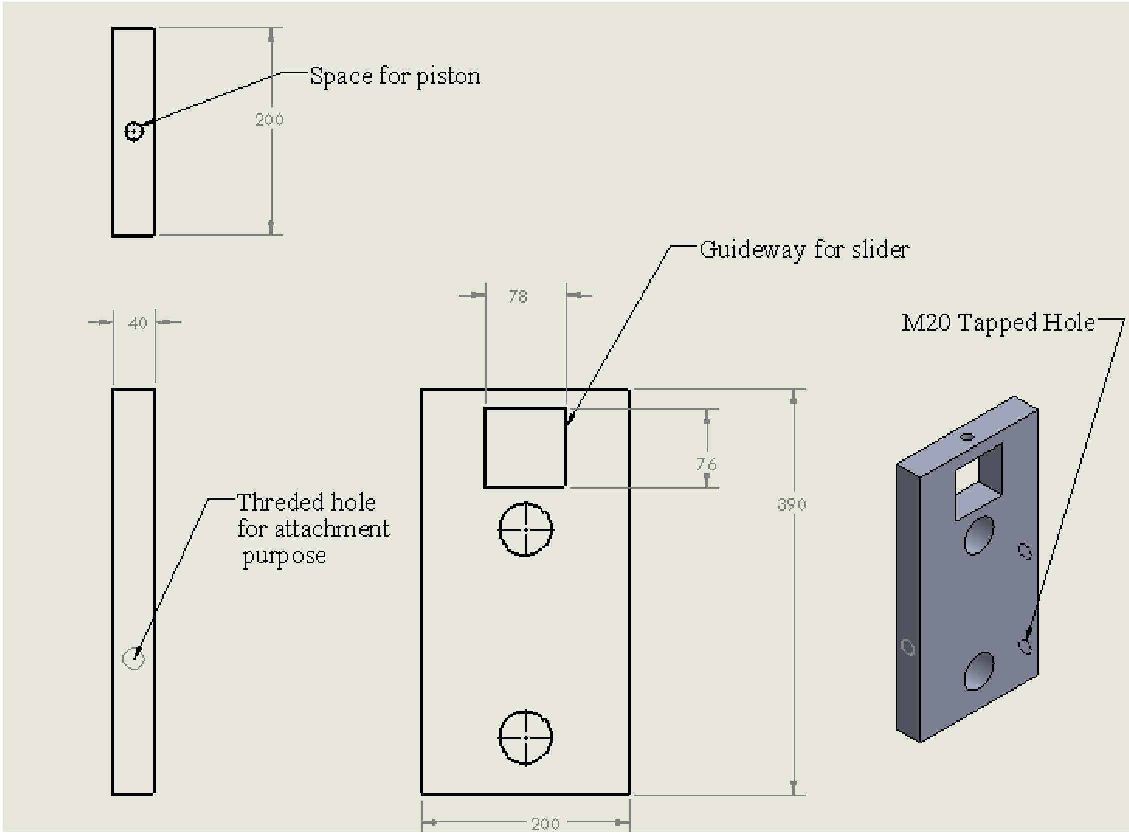

Figure 3.4.Vertical frame of feeder

3.3 Complete assembly of stepper feeder

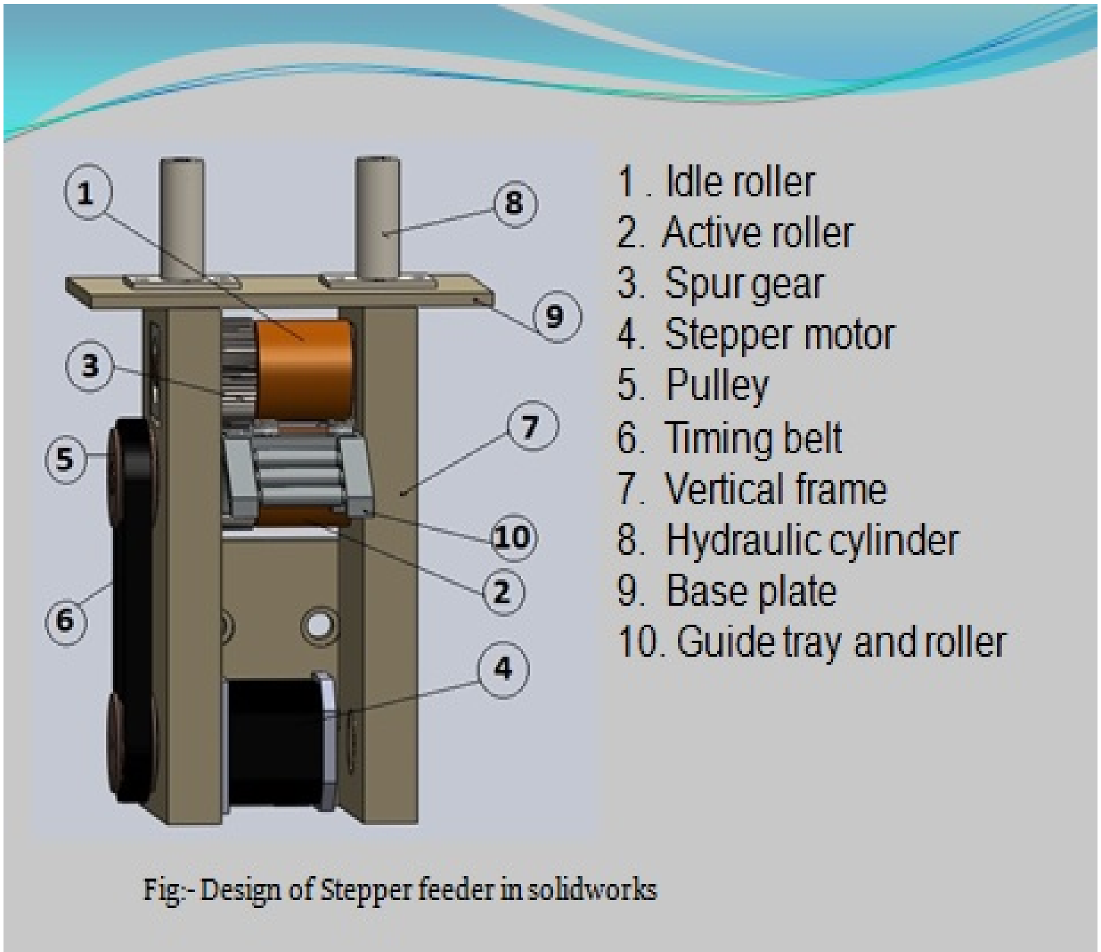

Figure 3.5. Design of Stepper feeder in solid works

Process and working:

Feeder device assist punch press by feeding metal strip or stroke.

It works in two steps in each cycle.

- Meshing of roller: when non –impacting (upward) strokes in power press occurs feeder device feed metal strip of required length.
- Dwell period: when required length of strip is fed to the press and impacting stroke is going to occur at that time the feeder roller must stop and disengaged .Engagement and disengagement of roller is achieved by pneumatic cylinder.

3.4 Cost of Stepper Feeder

- Stepper Feeder mechanism consist of following:

1. Drive circuit

2. Stepper motor

3. Eco controller

To know the price of all above components we enquired in Orion electronics, Bhandup.

Cost stated by company is as follow:

Table2.cost of components

Components	Price(rupees)
1.Stepper motor (25kg-cm)	3500
2.Drive circuit	10500
3.Eco controller (PLC)	8500
4.Other (frame , gear , pulley , roller , manufacturing cost)	20000 (approx.)
Total	42500

Whereas, traditional (pneumatic) feeder costs up to 2 to 3 lacs and demands more maintenance.

3.5 Analyzing gear pair for strength

- **Initial setup:**

Gear and pinion pair with following dimensions are modeled and imported in Ansys:

Components	Module(mm)	Teeth
Pinion	4	45
Gear	4	45

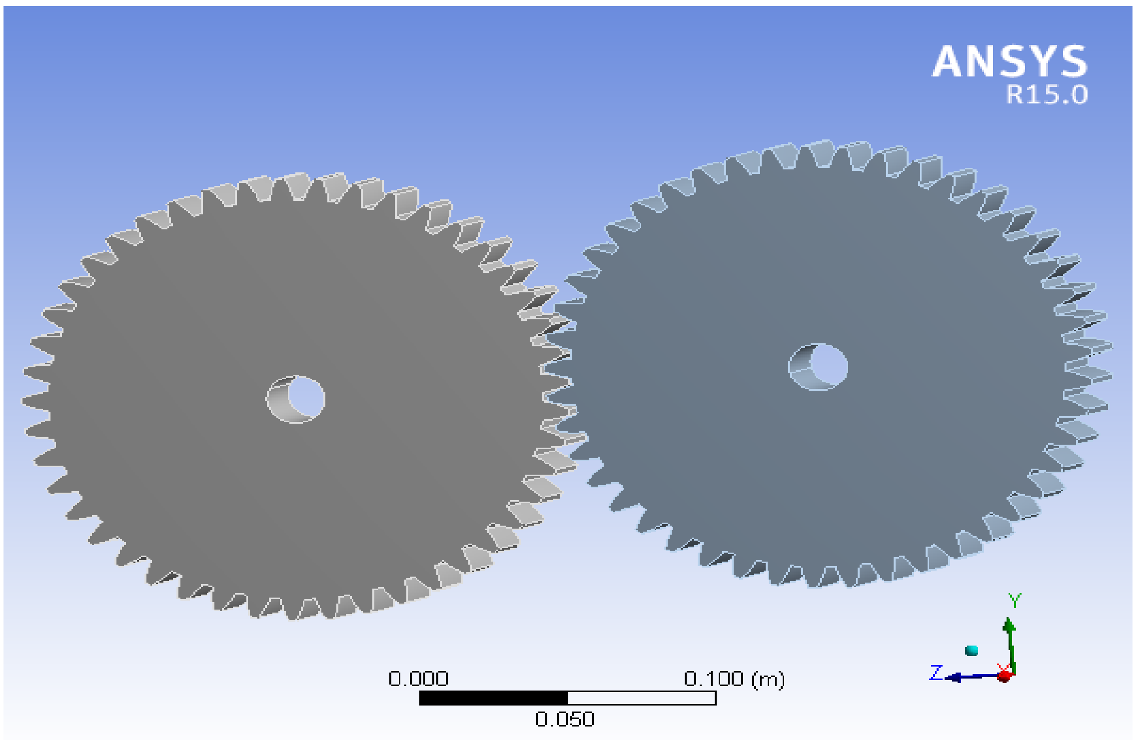

Figure 3.6.Initial Setup

Material Data:

- **EN8 (for Pinion)**

Density	7850 kg /m^3
Tensile Yield Strength	2.8269×10^8 Pa
Tensile Ultimate Strength	5.85×10^8 Pa
Young's Modulus	2.04×10^{11} Pa
Poisson's Ratio	0.29
Bulk Modulus	1.619×10^{11} Pa
Shear Modulus	7.907×10 Pa

- **EN24 (for gear)**

Density	7850 kg/m^3
Tensile Yield Strength	2.05×10^{11}Pa
Tensile Ultimate Strength	7.45×10^{8}Pa
Young's Modulus	4.7×10^{8}Pa
Poisson's Ratio	0.285
Bulk Modulus	1.5891×10^{11} Pa
Shear Modulus	7.9767×10^{10} Pa

- **Mesh:**

Medium fine mesh is applied to assembly in order to get satisfactory result as well as to minimize processing timing.

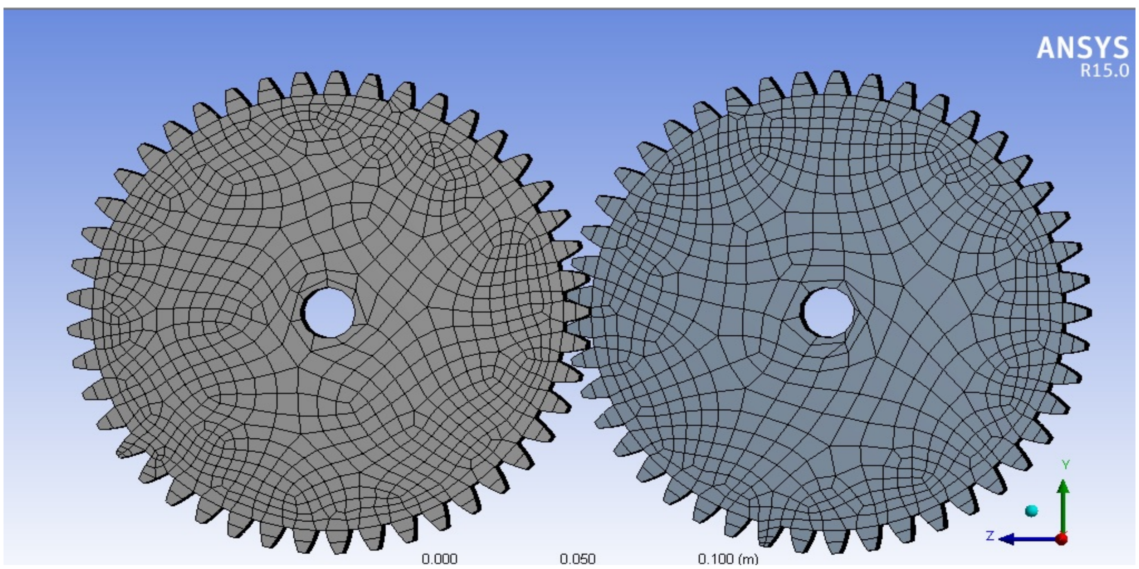

Figure 3.7.Meshed View

Statistics of mesh	
Nodes	36206
Elements	6800
Mesh Metric	None

- Boundary conditions:

Moment: 2.5 N-m (applied to pinion)

Cylindrical support is given to both gear and pinion

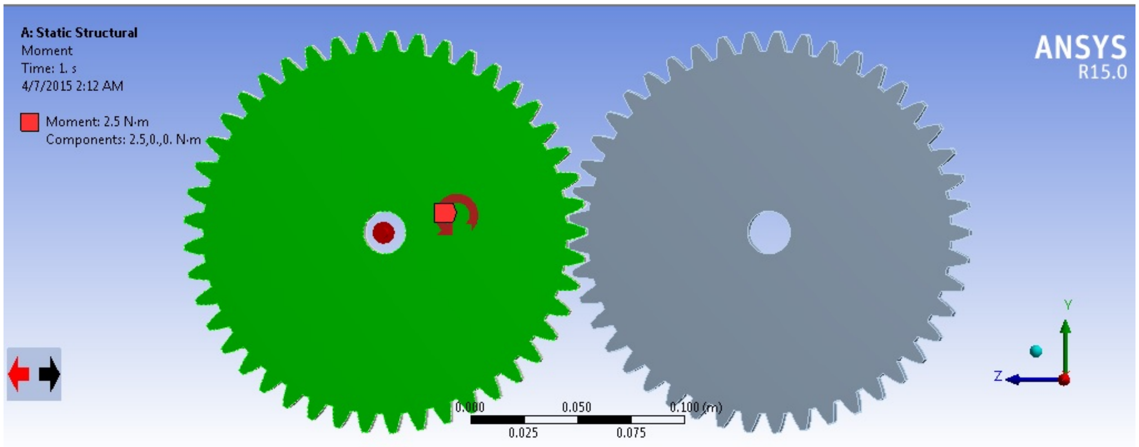

Figure 3.8.Boundary Conditions for Analysis

Table 3.Result of analysis

Object Name	Directional Deformation	Total Deformation	Equivalent Elastic Strain	Equivalent Stress
Definition				
Type	Directional Deformation	Total Deformation	Equivalent Elastic Strain	Equivalent (von-Mises) Stress
Results				
Minimum	-1.5151e-007 m	1.3875e-008 m	3.2044e-011 m/m	2.3299 Pa
Maximum	1.4342e-007 m	1.5179e-007 m	2.627e-006 m/m	5.2486e+005 Pa

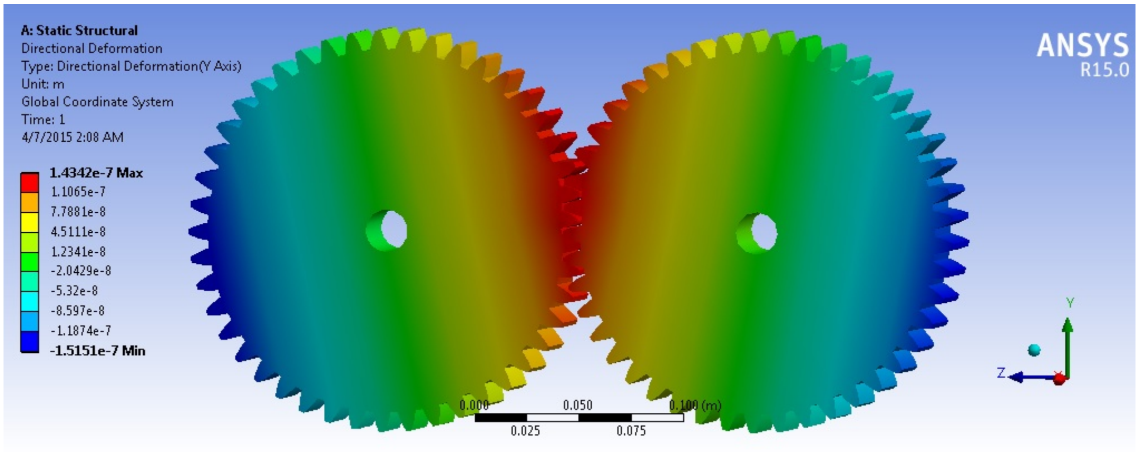

Figure 3.9.Directional deformation of gear-pinion pair

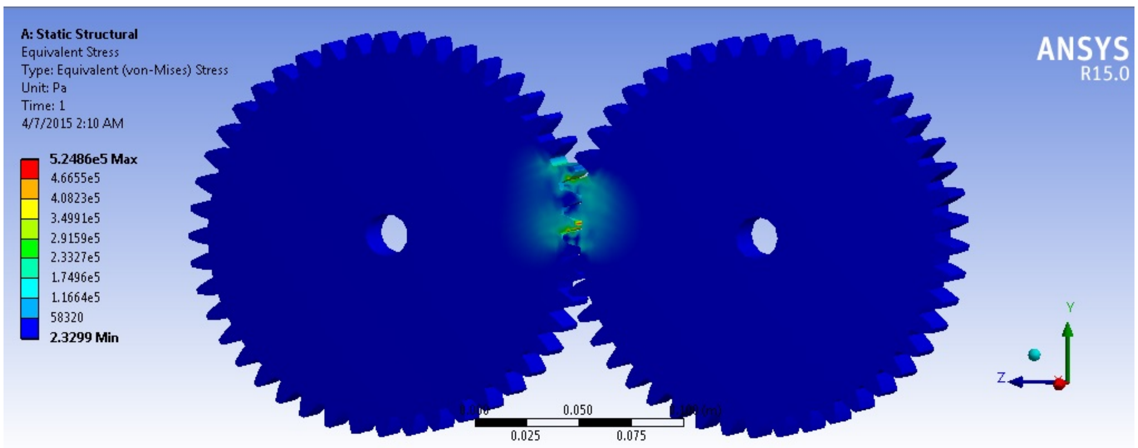

Figure 3.10.Equivalent stress induced in gear-pinion pair

Chapter 4

Results and discussions

4.1 Validation:

From the result of both mathematical and analysis (in software) confirms that design is safe and it will not get damage up to million cycles.

4.2 Result by mathematical method:

Checking for bending strength:

σ_b(induced)=5.37kgf/cm^2 >σ_b=1400kgf/cm^2 (bending design strength of pinion material)

Bending stress induced in the pinion is less than bending strength of the material.

4.3 Result by ansys software

Checking for bending strength:

σ_b(induced) =5.24 kgf/cm^2>σ_b=1400kgf/cm^2 (bending design strength of pinion material)

From both results it is observed that bending stress induced in the pinion is lesser than the bending strength of material of pinion (i.e. C45). Hence, it is confirmed that design is safe.

Chapter 5

Conclusion

- Stepper feeder device is designed and analyzed, successfully.
- Many problem associated with traditional (pneumatic and hydraulic feeder) are solved.
- Noise pollution is reduced, which is helpful for employees who are working in surrounding area.
- Material (metal strip) of any length, thickness can be fed at any speed to the punch press.
- Cost of Stepper feeder mechanism is lesser than traditional (pneumatic and hydraulic) feeder

Chapter 6

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Date: 5/3/2015

This is to certify that the candidates **SARFRAZ AHMAD**, **GAONKAR RAJESH**, **SHAIKH AYUB**, **SHAIKH MOHD MAAZ**, who are the students of **ANJUMAN-I-ISLAM'S KALSEKAR TECHNICAL CAMPUS** ,has completed their **B.E.(mechanical)** project "**MODELLING AND SIMULATION OF STEPPER FEEDER FOR PUNCH PRESS IN CADD SOFTWARE**" in "**UNIVERSAL WIRE FORMS**".

This project is the record of the authentic work carried out during the year **November 2014-March 2015**.They have done this project by themselves as a team. All the necessary details were provided from our side for the establishment of this project.

For UNIVERSAL WIRE FORMS

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