Design And Fabrication Of Pneumatic Bending By Using Ultra Sonic Sensor

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Abstract - *Nowadays , sheet metal industries had became the crucial part in every manufacturing industries such as mechanical, automobile, aerospace etc. the manual machining processes are replaced by automation tools and machines .the bending machine used in industries are mostly hydraulic which has many problems like leakage ,high maintenance cost and hydraulic fluid issues . for this purpose we have used the pneumatic in bending machine which uses air for bending rods and sheets with ultrasonic sensor having same efficiency as hydraulic bending machines and more economical.*

Key Words: **Pneumatic bending ,Hydraulic bending , Ultrasonic sensor.**

1.INTRODUCTION

In fast growing world of industrialization and automation we need simple machines with low operational cost and having high accuracy in operation. The pneumatic bending machine with ultrasonic sensor is the simplest design for bending elements with the perfection as needed. This machine can be operated by any unskilled operator as the ultrasonic sensor used in the machine requires only detection of obstacle for its working the pneumatic bending machine using ultrasonic sensor increases the productivity due to its automation capacity. earlier the skilled operators were required for performing bending operation which can now be avoided and the same skilled operator used for performing bending can be engaged in the task where skilled operation are required . The pneumatic bending machine using ultrasonic sensor is an environmental friendly bending technology as it uses air for its operation of bending rather than oil used in conventional hydraulic bending processes.

2. LITERATURE REVIEW

1. Paolo Albertelli et. al In this paper a methodology for performing an energy assessment of two different tube-bending machines is proposed. The methodology is based on the experimental approach suggested by the ISO 14955 but also propose a modeling strategy that allows extending the energy assessment comparison for the whole working range of the machines. The analysis shows that full electric bending machine allows saving a relevant quantity of energy. This advantage decreases as the production rate increases. In the scenario of containing the global warming, devising energy savings strategies in industry has become a proper and urgent matter. Since manufacturing is one of the most energy demanding sectors, research and the linked industries started tackling this issue proposing new eco solutions. In this paper, an experimental investigation of the energy saving opportunities in tube bending machines is performed and critically discussed. The analysis is carried out comparing an electrical tube bender and a hydraulic machine of comparable size. The experimental measured are also used to fit energy models that are used to extend the comparison considering different working conditions of the tube bending machines. The results show that relevant energy savings can be achieved introducing the electrical drives. Two tube-bending machines were analyzed and critically compared, focusing on their energy consumption. The first machine is a traditional hydraulic CNC rotary draw tube bending machine that is equipped with some servo electric axes (the booster and the boost clamp). All the other units are hydraulic. The analyzed electro-hydraulic machine. The working pressure set for the test was equal to 120 bars. The second machine is a fully electric CNC rotary draw tube bending machine. It is equipped with servo motors that are piloted by drives and a CNC controller. In this case all the machine units are driven by electrical axes. Focusing on the bending performance, the analyzed machines are comparable.

2. Hassanin Al-Fahaam et. al Human assistance innovation is essential in an increasingly aged society and one technology that may be applicable is exoskeletons. However, traditional rigid exoskeletons have many drawbacks. This paper has introduced a novel bending pneumatic muscle which can be used to develop soft exoskeletons. The paper has described the construction of a bending pneumatic muscle which is based on an extending McKibben muscle. By reinforcing one side of the muscle to prevent extension a bending motion is produced when the actuator is pressurized. The paper has experimentally assessed the performance of the novel actuator and an output force mathematical model for the proposed actuator has been developed. This model relies on upon the geometrical parameters of the extending bending pneumatic muscle to determine the output force as a function of the input pressure. The model has been verified against experimental results for a range of actuator sizes. To demonstrate the new actuators a soft exoskeleton glove has been produced. Extensor Bending Pneumatic Artificial Muscles were attached to the rear of each finger of the glove. Then pressurized actuators bend and apply forces to the rear of the fingers causing the finger joints to flex. By using EMG sensors to monitor a user's muscle activity, it has been shown that the glove reduces the amount of muscle effort needed to perform a number of simple grasps. Future work will seek to improve the mathematical model further by considering other losses such as rubber bladder impedance, the friction between the bladder and the braided sleeve and the friction between the fiber threads in the braid. This will be done to enhance the mathematical model and decrease the average percentage error. The glove described in this paper has only used open loop control.

3. Yoel Shapiro et. al We present a compliant single degree-of-freedom pneumatic actuator with large bending capabilities. Several actuator designs are compared and validated against the suggested actuation model. Repeatability, some dynamic properties and the affect of external loads are examined as well. Fluidic actuators (hydraulic and pneumatic) hold typical advantages over the more common electric actuators; they consist of fewer parts and have a lower weight and lower cost. These characteristics have drawn the attention of many researchers interested in miniaturization, several of whom reported that, at micro scale, fluidic actuators hold an advantage over electric actuators thanks to a higher force/volume ratio.

4. Han Gao et. al A dual-mode piston type pneumatic actuator with integrated piezo stacks was developed in this research. The piezo actuators were driven at a resonant frequency of 1.272 kHz to generate a first order bending vibration mode, or driven at 12.133 kHz to get a longitudinal vibration mode for reducing friction force. The vibration had a positive effect in reducing the stiction force, but the improvement of the actuator output force is not remarkable in presence of vibrations. In the dynamic friction measurement, a positive correlation between the friction force and the vibration amplitude was found for both modes. But it was found the increasing air pressure had an effect of reducing the friction reduction phenomena. Both of the vibration modes had a function of improving the friction characteristics of the pneumatic actuator by different levels but there is a limitation of sliding speed for friction reduction when the actuator works at longitudinal vibration mode. Overall, we envisage the development of low friction pneumatic actuators to be particularly important in applications requiring high precision position control, as well as in miniature piston-cylinder actuators which often suffer from high friction. In the future research, the authors would like to focus on optimizing the pneumatic actuator design, and better understanding of the friction reduction mechanism. The use of low cost piezo actuators will also be investigated for the commercial viability of this technology. Piston - cylinder pneumatic actuators are widely applied in various fields of automation and robotics. The sealing rings comprised in these actuators unfortunately introduce friction and affect the positioning accuracy and output force. In this work, piezoelectric actuators are built in the pneumatic actuators to introduce vibrations with lower friction force. The friction reduction effect is compared between the bending vibration mode at a resonant frequency of 1.272 kHz and the longitudinal vibration mode at a frequency of 12.133 kHz.

3. PROBLEM STATEMENT

The traditional rid or sheet bending processes are time consuming manually operated thus having low production rate & with more error in bending .with time the problem of low productivity and more errors in bending technology. But hydraulic bending technology has many of the disadvantages such as oil leakages problem ,uneconomical and environmental unfriendly. Thus we are here with the economical, environmental friendly and automatic technique of bending i.e. pneumatic bending.

4. METHODOLOGY

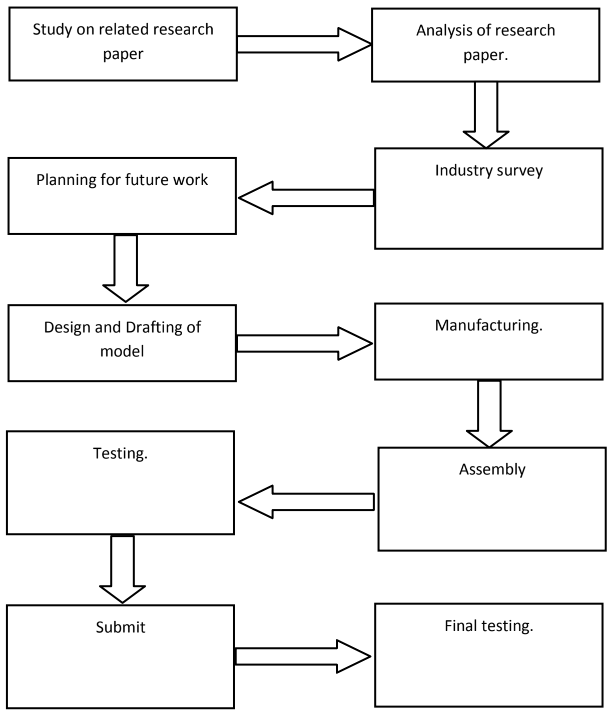

Chart -1: Methodology

5. CALCULATIONS

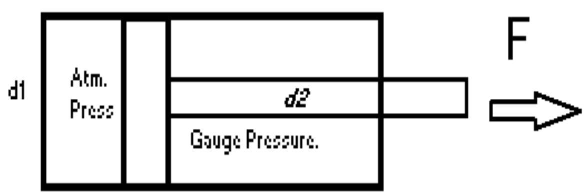

Fig -1: Double Acting Cylinder

Force acting on double acting cylinder on outstroke one a wheel break system

$$F=p\pi(d1^2-d2^2)/4$$

Where d1- diameter of piston

.d2-piston of rod diameter

$$F=P\pi(d1^2-d2^2)/4$$

Pmin =3bar

$=3*10^5pa=300kpa$

.d1=48mm

.d2=10mm

$$F_{min}=P_{min}\pi(d1^2-d2^2)/4$$

$$F_{min}=300*\pi(48^2-10^2)/4$$

Fmin=519305.2656

Fmin =519.305 N

Minimum force of cylinder= 519.305N

For maximum force

Pmax =6bar

=600kpa

$$F_{max}=P_{max}\pi^2-d2^2)/4$$

$$F_{max}=600*3.14(48^2-10^2)/4$$

Fmax=1038.610 N

Minimum force of cylinder acting is 519.305 N

Maximum force for cylinder acting

Consider maximum force 25% reduction on cylinder due to wheel

Fmax=1038.610*.75

Fmax=772.9578 N

Taking wheel force 25% reduction maximum force on cylinder is 772.9578 N

6. DESIGNING OF MODEL

The designing of model was done in CATIA V5 R16. The various components part drawings are created separately and by using this parts assembly is created.

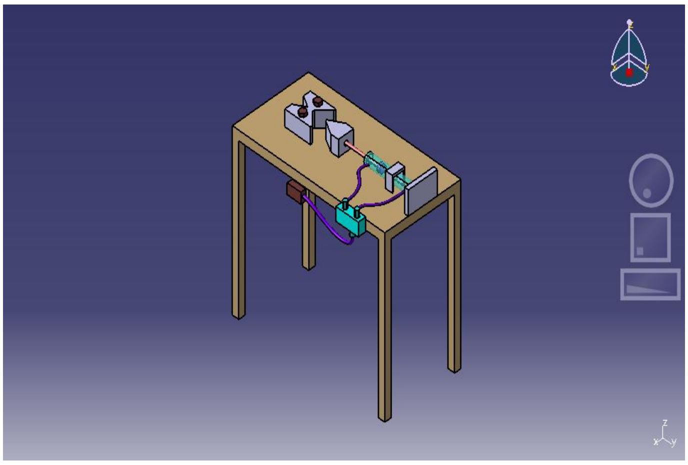

Fig -1: Assembly in CATIA

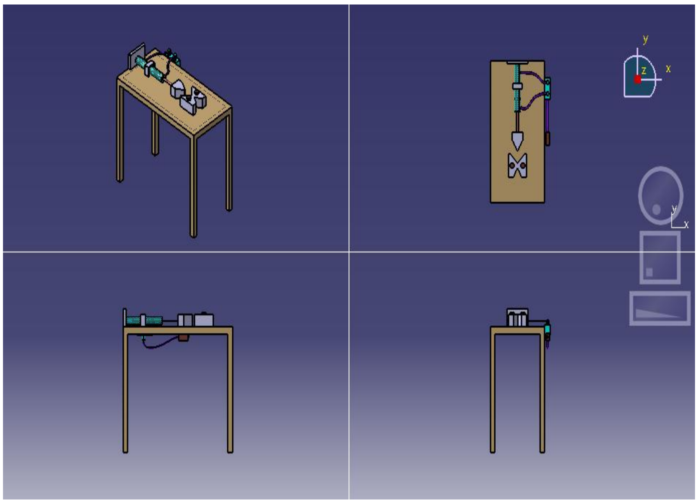

Fig -2: Various Views Of Design.

7. CONSTRUCTION AND WORKING

The main elements of pneumatic bending machine with 2& circuit 3/2 solenoid operated DCV ,hoses ,pneumatic cylinder ,punch ,die, relay etc.

The ultrasonic sensor has 4 terminals viz. VCC, ground echo and trigger .it first transmits low and high frequency signal from transmitter when this sound waves hits the obstacle they are reflected back to the receiver of the sensor .

This signal is given to the relay and then the 3/2 solenoid operated DCV starts its functioning .the compressed air from the compressor is than thus entered into the pneumatic cylinder and thus the forward & the reverse stroke of the cylinder takes place. the punch is attached to the pneumatic cylinder the sheet or rod to be bend is kept in sheet or rod to be bend is kept in contact with die and at the end of forward stroke the sheet or rod is bended.

Fig -1: Actual model

8. COMPONENTS USED AND THEIR SPECIFICATION:

1. Double Acting Cylinder: To get the required punching action double acting cylinder is used.

i. Stroke length- 125mm
ii. Bore dia-16 mm
iii. Shaft dia-10mm
iv. Type: Double Acting Cylinder.
v. Material: Aluminium.
vi. Series: MAL
vii. Model: MAL 16 x 200
viii. Action Type: Double Acting
ix. Rod Tye: Single Rod
x. Fluid: Air
xi. Power: Pneumatic
xii. Bore: 16mm
xiii. Stroke: 200mm
xiv. Working Pressure: 3-6 bar
xv. Operating Temperature: 0-70^{0}c

2. DCV: To direct the pressurized air Direction Control Valve is used.

i. Inlet Connections: 4 x 6 mm hose
ii. Outlet Connections: 4 x6 mm hose
iii. Pressure Range: 0-10kg/cm^2
iv. Ambient Temperature: -10 – 60^{0}c
v. Fluid Temperature: -10 – 60^{0}c
vi. Seal Material: NBR
vii. Exterior material: Polyster
viii. Wall Body Material: Brass/ Aluminium

3. Ultra Sonic Sensor: The distance between punch and die is fixed. When an object or work piece comes between punch and die, distance get chages. This change in distance measured by ultra sonic sensor. It sends the signal to DCV through relay and pressurized air actuates the double acting cylinder.

9. CONCLUSIONS

In this way it is concluded that the problem of oil leakage in hydraulic bending machine has over come. It has same efficiency like hydraulic bending machine which is more economical and can be operated by unskilled operator as well . Thus there is increase in productivity and the errors are reduced to minimum level.

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