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Design and Development of Defect Detection Machine with the Help of Arduino Uno and I.R Sensors

(PLASTIC PRODUCTS AND ITS PROBLEMS IN MANUFACTURING)

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Abstract- **Injection molding is one of the most commonly used manufacturing processes for the fabrication of plastic parts in net shape with excellent dimensional tolerance. A wide variety of products are manufactured using injection molding, which vary greatly in their size and complexity. Examples of common, everyday products that require plastic injection molding include automobile bumpers, mobile phone housings, television cabinets, compact discs, toys, and lunch boxes are all examples of injection-molded parts. This process requires the use of an injection-molding machine, raw plastic material, and a mold. A plastic material is melted in the injection-molding machine and then injected into the mold, where it cools and solidifies into the final part. The most commonly used thermoplastics are polystyrene, polypropylene, polyvinyl chloride, and acrylonitrile-butadiene-styrene (ABS). ABS resins are among the most versatile thermoplastics in the styrene polymers. The primary features and benefits of ABS are derived from the tree building blocks. Thermal stability and chemical resistance are derived from acrylonitrile, while butadiene provides impact resistance and toughness. Styrene imparts rigidity and processability to ABS. Therefore, they have practical toughness, high modulus, dimension stability, and good aesthetics for broad range of applications. Injection-molding process is a complex technology with possible production problems. They can either be caused by defects in the molds or more often by part processing. Many processing factors are involved in this process and have a great influence on the quality of final products. These factors can be usually classified into four categories: materials, injection machine, model design, and process**

I. INTRODUCTION

Todays' world is of new technology and development hence rapid working machine and equipment are necessary and equipment are necessary. The engineers are facing the challenges of bringing ideas and design into reality. New machine and techniques are being developed continuous to manufacture various products at cheaper rates and reduce human effort.

A Sorting Machine has two rollers and a conveyor belt mounted on the rollers of the machine, two I.R Sensors were mounted on left side and right side of the conveyor belt. D.C motor is fixed to the roller to guide the bottles or container. All two sensors and D.C motors are controlled by Arduino Uno. All the operation the performed by Arduino Uno by sensor processing.

A system approach was adopted for proper understanding of the project concept. The main challenge was to design platonic machine fulfilling three basic requirements economic viability, technical feasibility and social acceptance.

There are some machinery that do some work, are mainly operated by electronics means and are very expensive costly to maintain.

The main reason behind selecting this project is to reduce the time consumes by the workers to sort-out the defected bottles or container form the manufactured batch of 800 pieces.

The hopper allows the bottles to dropdown on the conveyor belt thorough pipe section. Rollers are driven by D.C motors.

II. LITERATURE SURVEY

A. Analysis of Incomplete Filling Defect for Injection-Molded Air Cleaner Cover Using Moldflow Simulation by Hyeyoung Shin.

The incomplete filling defects are caused by a wrong injection-molding temperature, resin burnout, insufficient shot volume, or low flow rate of molten plastics. During the filling stage, the hot molten polymer must fill the cold mold completely before it solidifies. It can be assumed that the processing temperature and the flow rate of molten polymer are maintained too high to eliminate unfilled sections and these lead to additional burr defect.

B. Review in Controlling Analysis of Injection Molding Machine by

Finding the solution approaches we concluded that controlling parameters of Injection Molding Machine is the main area into which the future work can be done. We found different Solution approaches out of which Case based reasoning, Control Algorithm , Control Algorithm MS Visual Web Developer 2005 Express Model , Predictive Control Methodology , Temperature Control by training & self-learning process, Multilayer group method of data handling algorithm.

C. Recent Methods for Optimization of Plastic Injection Molding Process by

CBR systems can determine a set of initial process parameters for injection molding quickly based on the similar case(s) without relying heavily on the expert molding personnel

III.CALCULATIONS

DESIGN AND IMPLEMENTATION

Given Data

$N_1 = 30rpm$

$N_2 = N_1 = 30rpm$

$D_1 = D_2 = 50mm$

$R_2 = \frac{D_2}{2} = 25mm$

T = 2 kg cm = 0.196133 N.M

C = 740 mm

SOLUTION

1. Pitch Line Velocity

$V_p = \frac{\pi * D_1 * N_1}{60}$

$V_p = \frac{\pi * 50 * 30}{60}$

$V_p = 78.5939$ m/sec.

2. Belt In Tension T_1 & T_2

(Since torque is exerted on the driven pully)

$(F_1-F_2)*R_2 = T$

$F_1 - F_2 = \frac{0.1961}{6025*10^{-3}}$

$F_1 - F_2 = 7.84$ (1)

3. Ratio Of Belt Tension

$\frac{F_1}{F_2} = e^{\mu*\theta}$

Where μ = 0.35 Leather Belt

$\theta = \pi - \frac{D_2 - D_1}{C} = \pi - \frac{50-50}{740}$

$\theta = \pi$ rad

$\frac{F_1}{F_2} = e^{0.35*\pi}$

$\frac{F_1}{F_2} = 3$

$F_1 = 3 F_2$ (2)

From Equation 1 & 2

$F_1 - F_2 = 7.84$

$3 F_2 - F_2 = 7.84$

$2 F_2 = 7.84$

$F_2 = \frac{7.84}{2} = 3.92$ N

$F_1 = 3*3.92 = 11.76$ N

4. Design Stress (S_d) (Assuming belt as chome tanned & wire laced with hand)

$S_d = 2.8$ to 3.8 Mpa (Assume 3 Mpa)

S_d = allowable stress * Joint stress

$S_d = 3*0.32$

$S_d = 2.46$ Mpa

5. Centrifugal Stress (S_{CF})

$S_{CF} = \rho * Vp^2 * 10^{-6}$

$S_{CF} = 970*(78.539)^2 * 10^{-6}$

$S_{CF} = 5.98$ Mpa

6. Belt Section (b*t)

$b*t = \frac{T_1}{Sd - S_{CF}}$

$b*t = \frac{11.76}{2.46-5.98}$

$b*t = 3.34\ mm^2$

7. Stress due to initial tension

$2*\sqrt{F_i} = \sqrt{F_i} + \sqrt{F_i}$

$\sqrt{F_i} = \frac{\sqrt{F_i}+\sqrt{F_i}}{2}$

$F_i = 7.314$ N

$b*t = \frac{F_i}{S_i} = \frac{7.314}{1.5} = 4.87\ mm^2$

$b_{max} = 1.33$ * smaller pully dia

$b_{max} = 1.33 * 50 = 66.5$ mm

assuming t = 8 mm

b*8 = 4.87

b = 0.60875 mm

$b < b_{max}$

Hance Design is Safe

8. Maximum Velocity & Power

Max.Tension , $F = F_1 + F_c$

$F_c = mv^2$

M = area *length *density

$M = b*t*l*\rho$

$M = 6.08*10^{-4}*0.008*1*970$

$M = 4.71*10^{-3}$ kg

$F_c = 4.71*10^{-3}*(78.53)^2 = 29.102$ N

Now,

$F = 11.76 + 29.102 = 40.862$ N

Condition for Max.Power is

$F = 3 F_c$

Max Velocity,

$$V_{max} = \sqrt{\frac{F}{3M}} = \sqrt{\frac{40.862}{3*4.71*10^{-3}}}$$

$V_{max} = 53.77$ m/s

Maximum Power Capacity (P_{max})

$P_{max} = (F_1 - F_2) * V_{max}$

$P_{max} = (11.76-3.92) * 53.77$

$P_{max} = 421.556$ Watt

$P_{max} = 0.421556$ Kw

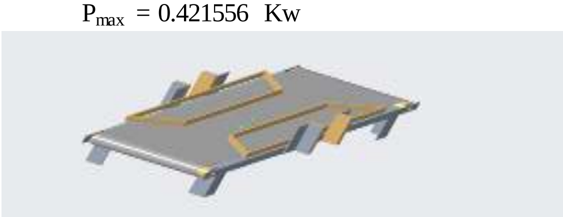

Fig. 4.1 Cad-Model

IV. WORKING

Product which is to be inspected The hopper allows the product to dropdown on the conveyor belt thorough pipe section. Roller are driven by D.C motors. Then product comes in front of the sensors the sensors inspects the height of the product for that we have to adjust the sensors height as per our requirement is products height is more than our predefined height of sensors then the rays coming from emitting light it cuts down due to the excess height of product this signal is passes to the controller and it gives the signal to another motor on which the throwing arm is fixed which throws the defective product out from the conveyor belt.

Fig.5.1 Fabrication model

V. CONCLUSION

Speed of conveyor –belt should be adjustable as per the production rate. Speed of throwing arm is also adjustable according to detection time taken by sensors.

- Die & Ram is generally cooled by normal tap water then It's taking 9sec to cooling down the injected product. After the Application of coolant instead of tap water it Takes 6sec to cool down the injected product.
- It is difficult to separate the defective product from Quality product so we have design and fabricate the Separation machine which is separates the defective products from Quality Products.

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