

Graphical Analysis of u Shaped Components Feeding in a Vibratory Bowl Feeder

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Abstract - Automation is becoming an important part of manufacturing industry in order to cater the requirements of production and manufacturing lines by making the system to operate automatically. Industries are developing by the introduction of automations, and feeders form an integral part of automated assembly and manufacturing lines. Less production time, increased accuracy and repeatability, less human errors, higher rate of production, safety assurance are some of the key benefits of automated industry. The present study aims to analyze the graphical analysis of U-Shaped components in a Vibratory Bowl Feeder which is an automatic feeding system of components of desired shape and orientation. Some modifications were done in the track of the feeder to make the flow of components continuous by doing hit and trial method so as to prevent any errors in the result. A deep experimental study is done on the feed rate of components by changing input parameters which were set to be part population, length of part, and frequency of operation. The results obtained are studied graphically and conclusions are drawn concerning the best performing parameters.

Keywords - Automation, U-Shaped Components, Vibratory Bowl Feeder

1. INTRODCUTION

In modern industries, the assembly lines are so equipped so as to feed the engineering parts in the correct orientation at the work station and for this purpose Vibratory Bowl Feeders are widely used which is the most common and most used methods in automated feeding and orienting of industrial parts. Vibratory Feeders are machines which are commonly used to feed components of small sizes like:- screws, needles, etc. A bulk of randomly oriented parts is stored in the feeder and is sent in discrete form to the machine to which it is attached. These types of feeders are also used where there is mass production of a particular type of product. Vibratory feeders are used as an alternate to the manual feeding, saving time and labor cost. In comparison to other conventional methods, this one is the most cost effective and environment friendly. Major applications of such feeders can be seen in manufacturing industries, automation industries, pharmaceutical industries, etc.

2. EXPERIMENTAL ARRANGEMENT

Necessary modifications were made in the feeder so as to obtain the desired orientation of parts and feed rates without any considerable error. One of the major change which was made is the making of a slanting rail at the end of the track of feeder so as to feed the U-Shaped component in proper orientation. The design of inclination of the sloping rail ensures equal feeding probability of the component and it was ensured that the inclination should be optimum so as to avoid jamming of components on the track.

Table 1 – Feeder and Part Description

Sr. No.	Specification	Description
1.	Material of Work piece	Iron
2.	Height of Work piece	10mm
3.	Bowl Diameter	30mm



Fig.1 – Modified Feeder's Track



Fig.2 – Vibratory Bowl Feeder

3. PERFORMANCE ANALYSIS

The components used for the current study were U-Shaped metal clips. The performance of the vibratory feeder was studied based on the following parameters.

A: Part Population in the Feeder

The number of components present in the bowl of the vibratory feeder at any instant of the time is known as the Part Population. This parameter can influence the feed rate as on increasing the number of components the feed rate tends to increase.

B: Frequency of Operation

On doing a series of trials of runs at different frequencies, it was observed that the range of 35-50Hz was the optimum range for the study. Also, it is concluded that with an increase in the frequency, the feed rate also increases.

C: Part Length

Another important parameter which affects the feed rate of feeder is the part length of the component. The length of the component used should be so chosen that it easily climbs up the inclination of slope on the track. It was observed that the shorter parts were not able to accommodate higher frequencies and the longer parts were too long for the curvature of the track. The part lengths of 8mm, 10mm, and 15mm were used and a Graphical Analysis is carried out by using one factor at a time.

4. RANGE OF PARAMETERS

Part Population in the Feeder: 100-300
 Frequency of Operation : 35-50 Hz
 Part Length : 8 mm - 15 mm

5. GRAPHICAL ANALYSIS

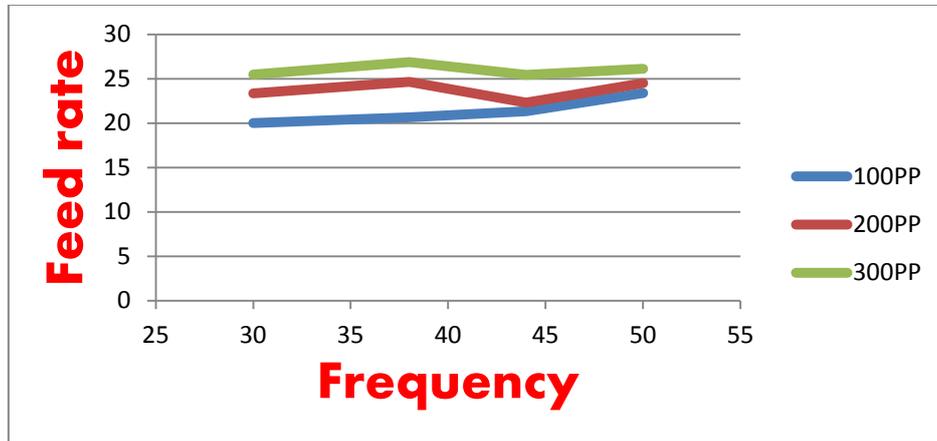


Fig. 3 Feed Rate vs. Frequency (Part Length - 08mm)

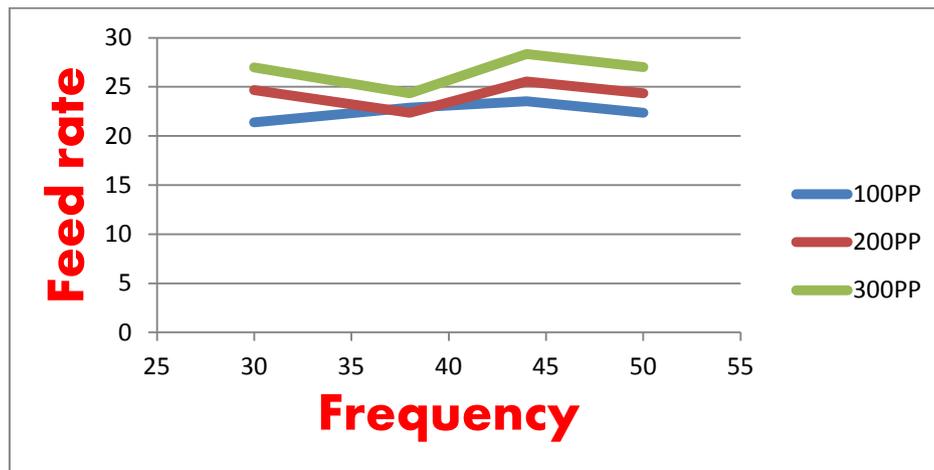


Fig.4 Feed Rate vs. Frequency (Part Length - 10mm)

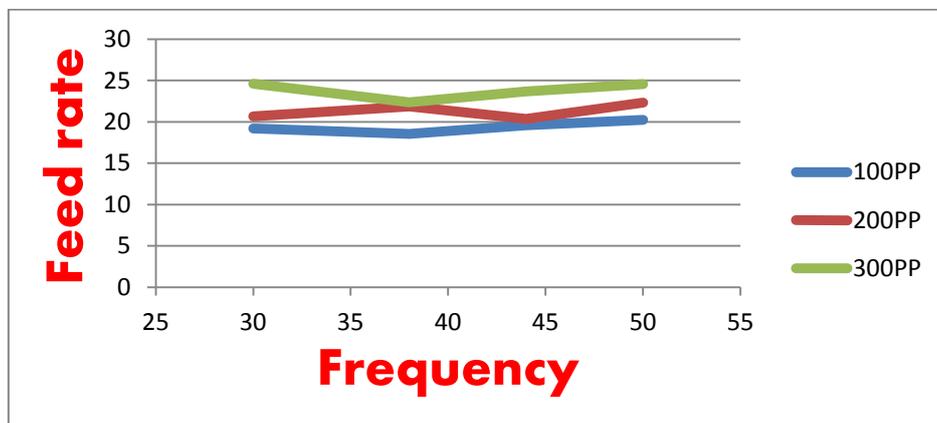


Fig. 5 Feed Rate vs. Frequency (Part Length - 15mm)

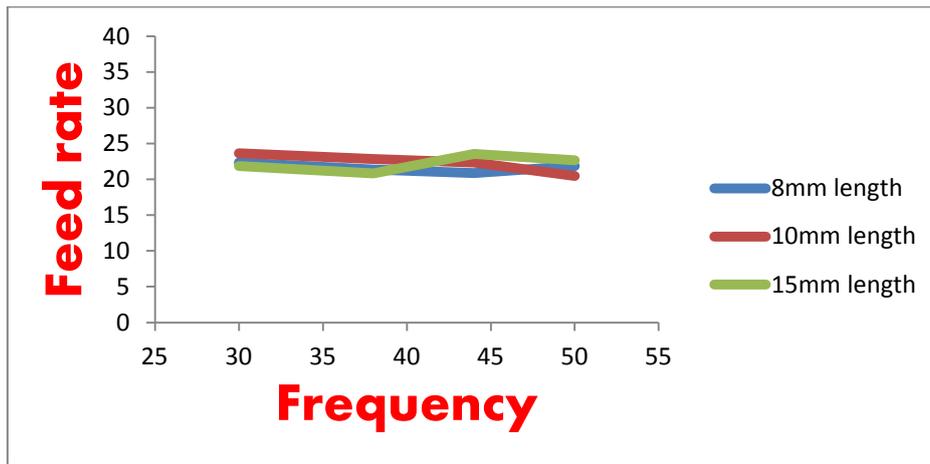


Fig.6 Feed Rate vs. Frequency (Part Population - 100)

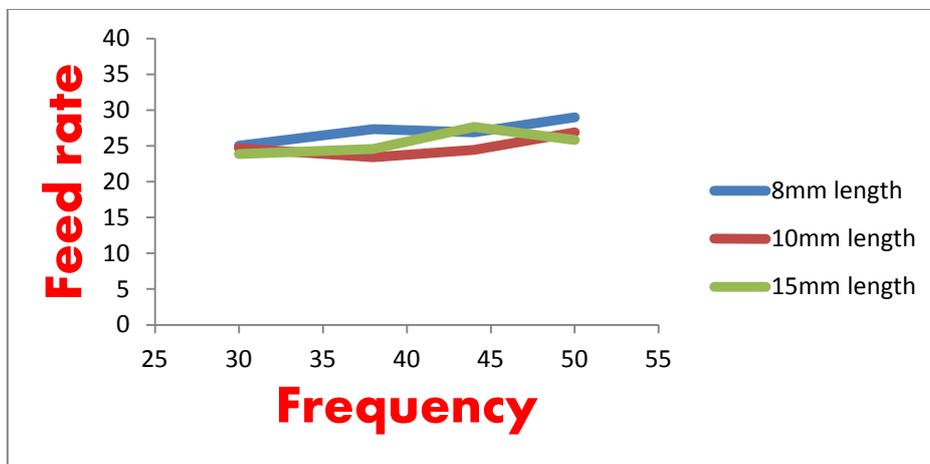


Fig.7 Feed Rate vs. Frequency (Part Population - 200)

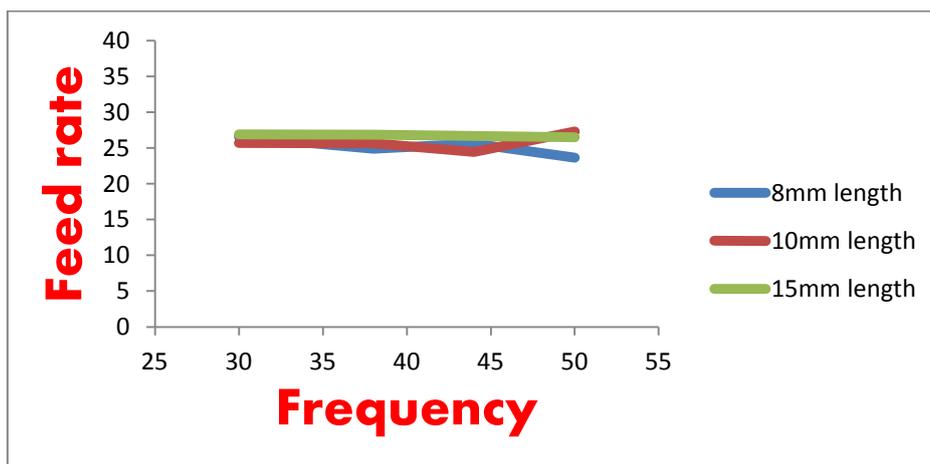


Fig.8 Feed Rate vs. Frequency (Part Population - 300)

6. CONCLUSIONS

The present study on the Vibratory Feeder aims to generate a common procedure of graphical analysis on the feeder's performance by taking into consideration a Vibratory bowl feeder [2]. The following points explain the effect of the input parameters on feed rate:

Effect of Frequency on Feed Rate

The results of graphical analysis show that the feed rates increases on increasing the operating frequency. It was observed that the free flow of U-Shaped components was slow when the operational frequency was below 38Hz; also the components were found to jump off the track of feeder on increasing the frequency above 50 Hz.

Effect of Part Population on Feed Rate

The results in graph 7 show that on increasing the part population, the feed rate is found to be increasing. Part population 200 gives the optimum feed rate. We can conclude from this, that on increasing the frequency, the feed rate may decrease due to the components bouncing off the track and the u-components getting interlocked. However, the most continuous behavior was shown by part population 100 shown in graph 4. It shows that on using less number of components, the feed rate is found to be decreasing because the number of parts was not enough to provide a sufficient force to the successive parts to climb the inclination and move forward the track.

Effect of Part Length on Feed Rate

The graphs 5 show that on increasing the Part Length the feed rate decreases. However, the best feed rate was obtained for the optimum length of 10mm. The reason behind these results is that components having short length are not able to accommodate higher frequencies and climb up inclination due to light weight.

7. SUMMARY

In the present study, the track of the feeder was modified so as to obtain the free flow of the u-shaped components. We considered three input parameters for this study which were Part Population, Part Length, and Operational Frequency. The results obtained shows that the highest feed rate is obtained at a frequency of 44Hz for the part length of 10mm with part population 300.

In manufacturing and automation industry, it becomes important to deliver the components at a controlled rate to successive stages in a desired orientation. The parameters used in this study can be useful in industrial applications of U-shaped components such as U-clips, staple pins, bent wires etc.

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BIOGRAPHIES



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