Foam Splitter

Mechanical and Aerospace Engineering
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Abstract

This project is a collaborative effort between Sekisui Voltek and Trine University. Sekisui wants a proof-of-concept lab testing machine that splits closed-celled polyolefin foam into two rolls autonomously. Two sets of spring-loaded rollers drive the splitting process and provide a pinching force to keep tension on the foam and prevent it from slipping during the splitting process. An electromagnetic brake provides tension on the infeed spool. After the split, foam is re-rolled onto two outfeed shafts controlled by a PLC and integrated distance sensors. The overall goal of this project is to create a machine that will uniformly split an entire roll of foam autonomously and re-roll it onto removable outfeed shafts.

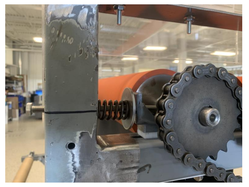
Customer Needs and Requirements

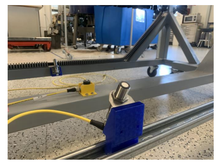
Split Foam
- Able to split multiple thicknesses of foam
- Provide adequate force to the rollers to split foam
- Prevent foam from slipping through rollers
- Tension foam at input

Reroll Foam
- Reroll split foam onto 3” diameter cardboard tubes
- Accommodate foam which does not split down the middle

Automation
- After staging, machine does not require operator interference to complete split and reroll
- Easy to use interface

Concept Selection

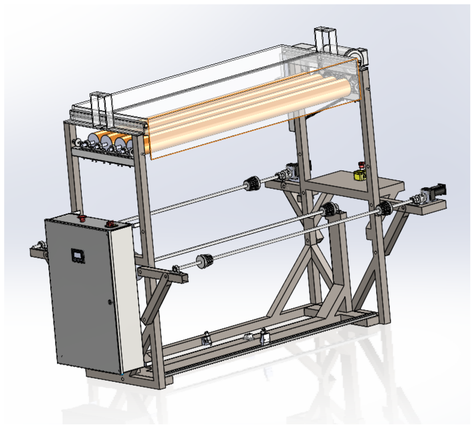




- Spring loaded rollers – creates pinch force stopping foam from slipping
- Magnetic Particle Brake – produces tension before the split point
- Ultrasonic sensors – Monitors ensure foam is uniform while rolling up

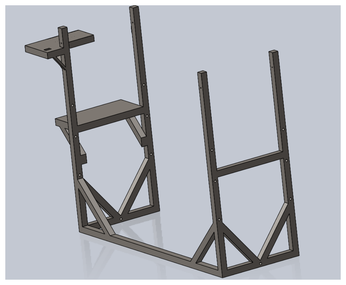
Design Solution

A tube framed machine consisting of 2 spring-loaded rollers, 3 motors, 5 sensors, a PLC, and 2 mobile frames were constructed to achieve a uniform and consistent split.



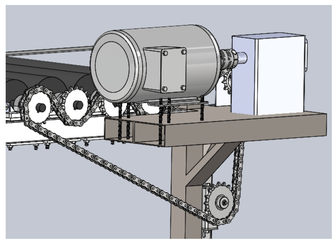
Manufacturing

Frame



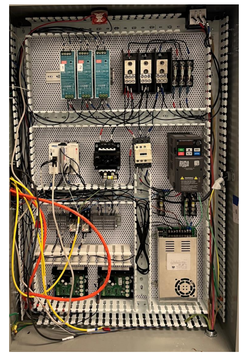
- Pre-assembled frame
- Modified rails for spring loaded rollers

Power Train



- 2 [hp] AC motor
- 1750 Max [rpm]
- 15:1 gear reducer
- ANSI-50 Chain
- Gear Chain Tensioner

Electrical Panel



- PLC controlled motors and brake
- Graphical interface

Final Assembly

- External wiring ran to electrical panel
- Acrylic guards protect rollers

Testing and Validation

RPM validation:
- Test to see if the RPM that was requested is what was being output

Code RPM	Measured RPM
99.71	98
33.11	34.4
17.62	19.2
10.62	12
7.12	8.57
4.62	6.7
3.75	6.7

Figure 2: Right motor RPM

Code RPM	Measured RPM
99.71	97.8
33.1	33.5
17.62	18.36
10.62	11.5
7.12	8
4.62	5.7
3.75	5.7

Figure 3: Left motor RPM

Sensor Validation:
- Test to check the accuracy of the ultrasonic sensors

Measured Distance	Sensor Distance
5	5.16
10	9.73
15	14.75
20	19.5
25	24.71
30	29.6
35	35.43

Figure 4: Right sensor distance

Measured Distance	Sensor Distance
5	5.31
10	9.96
15	15.02
20	20.07
25	25.03
30	29.99
35	35.43

Figure 5: Left sensor distance

Full system test:
- Full test to split and reroll foam automatically

Figure 1: Full system test

Acknowledgments

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