# Thiele Technologies Vacuum Pick Project


Mechanical Engineering

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**Sponsor**: Thiele Technologies

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## Abstract


Thiele Technologies presented us with a motion profile optimization project for one of their vacuum pick systems. A previous iteration of this particular system had a cam and follower actuated scissor system that provided the desired motion profile. This system was complicated to setup, consisted of many parts, and encountered stability issues with heavier objects. A recent redesign of the system eliminated many parts and greatly simplified the mechanism by utilizing a double-rocker fourbar and a driver dyad. Although the newer design was easier to set up, it occasionally experienced clearance issues. Our team was tasked with designing a solution to the clearance issues while maintaining as much of the recent redesign as possible. Designing a system that closely resembled the previous design ensured that it could easily retrofit into existing units. Machine design fundamentals were utilized to optimize the motion profile of the fourbar linkage and provide Thiele Technologies and their customers with a cost-effective solution to improve machine reliability.


## Design Criteria

- Motion profile must not have negative vertical translation for the first 1.5 inches of horizontal translation.
- Design must not add any degrees of freedom to the system to avoid complicated setup and adjustment.
- Design must fit into current cabinet while utilizing existing geometry and current placement of feed wheel and magazine feed ramp to avoid additional design alterations.
- Design must utilize existing constant angular velocity input to drive the fourbar mechanism.

## Motion Profile Comparison


## SolidWorks Design Model

## Design Method

**3 Position Synthesis** was used to find appropriate link lengths for the double-rocker fourbar linkage.

Once the lengths for links 2 & 4 were determined, a graphical analysis of the cabinet provided the dimensions for link 3 to ensure proper placement of the coupler

## Driver Dyad Graphical

## Prototype

## Motion Analysis Data

| Time [sec] | Localized X Displacement [in] | Localized Y Displacement [in] | Y Displacement [illegible] |
|---|---|---|---|
| 0 | [illegible] | 2.88962 | [illegible] |
| 0.01 | [illegible] | 2.89044 | [illegible] |
| 0.02 | [illegible] | 2.89442 | [illegible] |
| 0.03 | [illegible] | 2.90031 | [illegible] |
| 0.04 | [illegible] | [illegible] | [illegible] |
| 0.05 | [illegible] | 2.91713 | [illegible] |
| 0.06 | [illegible] | 2.92734 | [illegible] |
| 0.07 | [illegible] | [illegible] | [illegible] |
| 0.08 | [illegible] | [illegible] | [illegible] |
| 0.09 | [illegible] | [illegible] | [illegible] |
| 0.1 | [illegible] | [illegible] | [illegible] |
| 0.11 | [illegible] | [illegible] | [illegible] |
| 0.12 | [illegible] | [illegible] | [illegible] |
| 0.13 | [illegible] | [illegible] | [illegible] |
| 0.14 | [illegible] | [illegible] | [illegible] |
| 0.15 | [illegible] | [illegible] | [illegible] |
| 0.16 | [illegible] | [illegible] | [illegible] |
| 0.17 | [illegible] | [illegible] | [illegible] |
| 0.18 | [illegible] | [illegible] | [illegible] |

## Conclusion

Our team believes that this design offers the best solution to the motion profile problem while retaining the lean design and simplicity of the machine. Customers should experience even greater reliability at a reasonable cost with no adverse design attributes.


This project would not have been possible without the contributions from Thiele Technologies. Our team can not thank Thiele enough for this opportunity to apply fundamental Engineering principles to real world challenges with tangible results.


**Reference:**


Norton, Robert L. *Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines*. New York: McGraw-Hill, 2012. Print.


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