

# Three Phase Variable Speed Control

Bryce Morrison, Jeffrey Klossner, Enderson Naar, Rashid Abuelmaali  
Alfred University  
ra12@alfred.edu

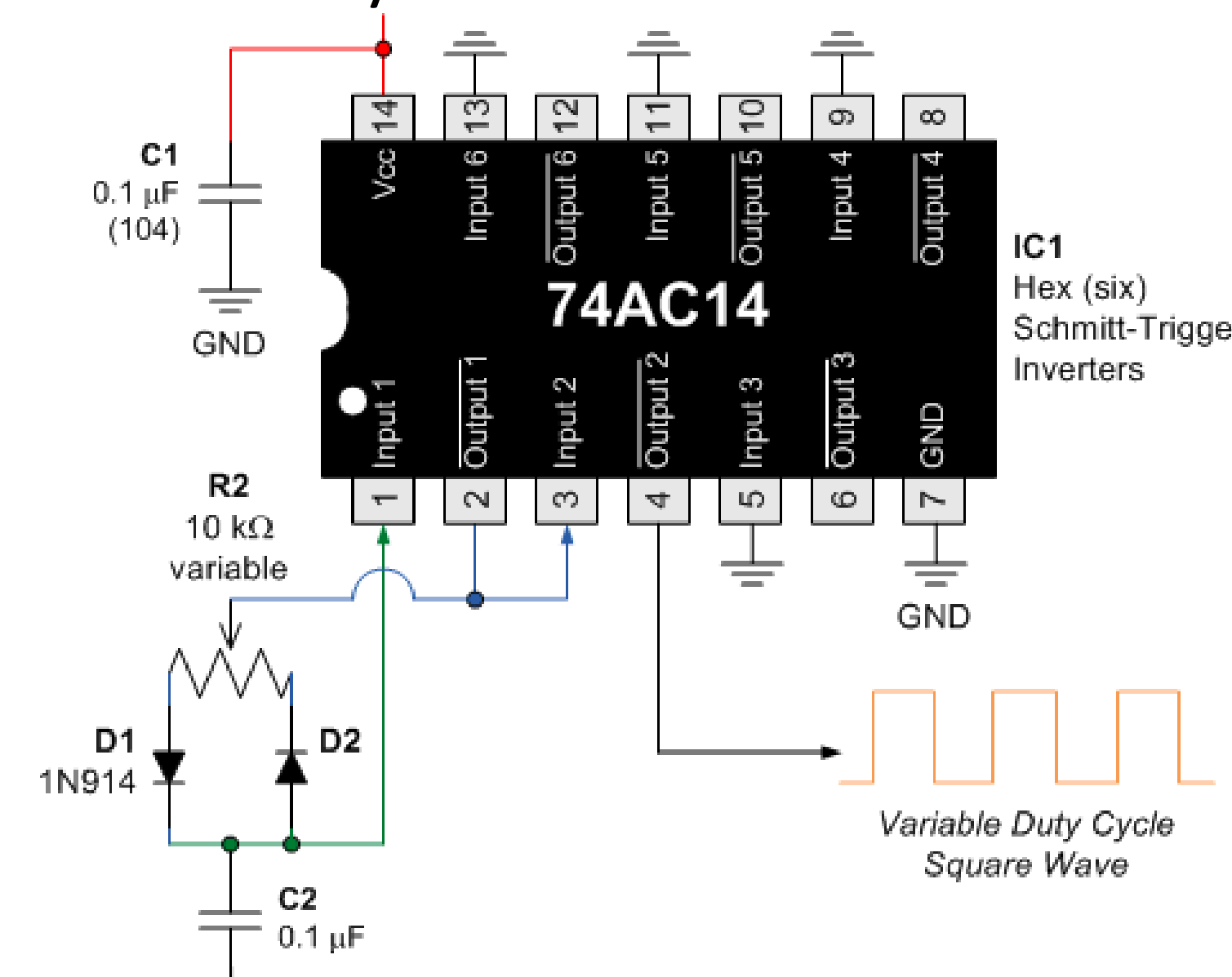


## Introduction: Three Phase Power

- Using AC instead of DC
  - Cheaper to generate AC over DC
  - Higher Efficiency
  - AC converted into DC
  - The loss of energy during transmission is negligible for AC
  - AC stepped up and down from one level
- Variable Speed Control
  - Type of adjustable-speed drive used in electro-mechanical drive systems
  - Controls AC motor speed and torque
    - Varies motor input frequency and voltage
  - Used in applications from small appliances to large compressors
  - About 25% of the world's electrical energy is consumed by electric motors in industrial applications,

## Ideas and discussion

- Pulse Width Modulation (PWM)
  - PWM component controls the voltage output of many different operations
  - Ranges from the light output in an LED to the rate which a motor operates.
- Three Phase over Single Phase
  - Instantaneous power in single phase system drops to zero as in single phase
  - In three phase system the net power gives continuous power to load
  - Three phase will have higher efficiency



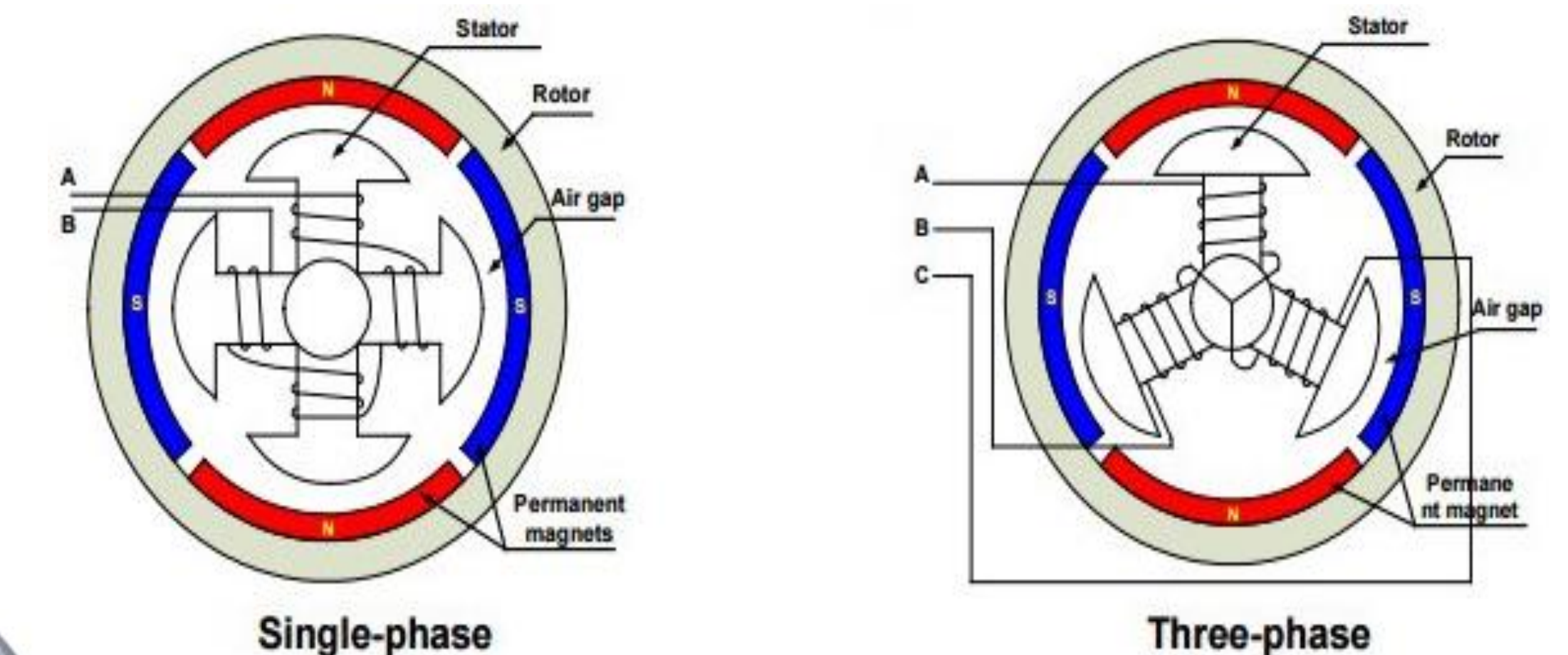
## Application

- For our application the PWM will be controlling the variable speed of the motor used.
- This will allow an adjustment of the motor speed to fit the application at hand.
- The three phase motor will save more in cost
- Be more efficient in any application needed
- The power delivered will be constant, instead of pulsating like it would in single phase motor



## Conclusion and future works

- We are planning on using a three phase motor design for a semi-automatic pallet wrapper
- This semi-automatic pallet wrapper will be used by the Arc of Steuben light assembly factory, as we are doing this project through C.R.E.A.T.E.



## \*References

- <https://blog.tripplite.com/single-phase-vs-three-phase-power-explained/>
- [https://commons.wikimedia.org/wiki/File:Synchronized\\_Pulse\\_Width\\_Modulation\\_Waveforms\\_for\\_a\\_Three\\_Phase\\_Current\\_Source\\_Inverter.JPG](https://commons.wikimedia.org/wiki/File:Synchronized_Pulse_Width_Modulation_Waveforms_for_a_Three_Phase_Current_Source_Inverter.JPG)
- <https://laheatingairconditioning.com/3-phase-vs-single-phase-ac-motors>
- <http://aegispower.com/index.php/blog/179-what-s-the-difference-between-single-phase-and-three-phase-ac-power-supplies>

Single Phase	Three Phase
Unit Requires $\leq 1000$ Watts	Unit Requires $> 1000$ Watts
Fewer Design Costs	Lower Labor Handling Costs
Less Complex Design	Greater Conductor Efficiency
Many Application Uses	Higher Power Load Capability

	Single-phase induction motor		Three-phase BLDC motor	
Load rate	Efficiency	P.F.	Efficiency	P.F.
20%	48.7%	0.550	76.2%	0.776
40%	68.7%	0.615	89.2%	0.867
60%	75.7%	0.702	90.4%	0.905
80%	79.6%	0.860	90.5%	0.947
100%	80.8%	0.930	90.8%	0.973