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Advances in Energy-Efficient Manufacturing using Industrial Robotics

Alexander Coronis and Khalid Tantawi*

Department of Engineering Management and Technology
University of Tennessee at Chattanooga, Chattanooga, TN
***For Correspondence: khalid-tantawi@utc.edu**

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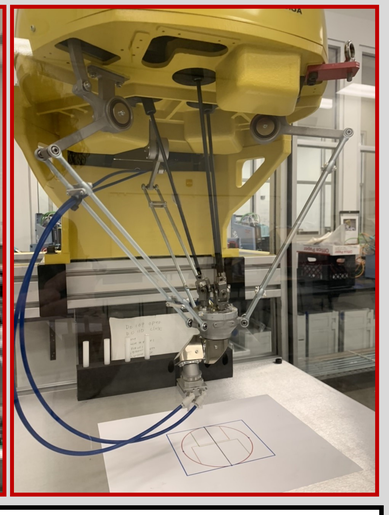
Introduction

- Over the years, the ability of production plants to operate in a faster and more efficient manner has consistently grown and expanded as technology has further developed.
- This growth is a result of the constantly steady advances of industrial robotics.
- In 2016, for the first time, the electronics industry exceeded the automotive industry in demand for industrial robotics in the Asian markets of China, Japan, and Korea.
- Worldwide, the electronics sector's share of the robotics market rose steadily to 32% in 2017, almost equal to the automotive sector (33%) [1].
- This change indicates that sectors that have not been historical markets for industrial robotics, are now adapting to this robotics revolution.
- **Improvements in Industrial robotics for Energy Efficiency [2]:**
  - ◊ **Improvements in Hardware Selection:** such as an improved selection of the robotic systems, new mechanical components that reduce energy use, being able to be more compact, and finding different usages of a robot's movement.
  - ◊ **Improvements in Software**
  - ◊ **Improvements in both hardware and Software.**



Pictures taken at Chattanooga State Community College

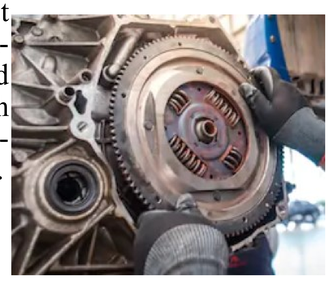
Some Practices Used

1) Improvements by Proper System Selection:

- This method of energy efficiency is described as finding different systems or programs that will exceed the current ones [3]
- As a result, the robots and factories using them become more energy efficient. For example, in a study from 2014, Arne Gloddea and Mohsen Afrougha [3] had found that a robot used in a industrial setting was actually taking more actions to complete a task than it should.
- To counter this, they created 2 new types of parts systems for the robot's task that allowed it to move less freely and faster

2) Improvements in Mechanical Hardware:

Impovements have also been performed in the creation of energy efficient parts for the robots that will use less power as well as storing energy. For example, flywheels have been used in industrial robotics to give the robot more inertia based motion. Capacitors, which store electric charges, and hydropneumatic accumulators, which are liquid-based energy storage systems have also been used in robotics .



3) Improving Robotic Movement Paths

Similar to how the study in improved selection systems and how flywheels are used to give robots more inertia to move faster and more freely, energy efficiency in robotic movements refers to how machines can be edited, adjusted, or remade to make more compact movements that save time, money, and energy.

4) Compacting Machines and Housing Less Space

As all machines become more advanced, you can see a change in not only the speed and efficiency of the machine itself, but it is also likely that it will become more compact as time goes on, and this factor applies to industrial robotics as well. Because of this, we have seen machines become smaller and take up less space, meaning that they will take less effort to store and house which would be very cost effective and would use less heated area.

Drawbacks

- One of the major issues with automated robots is that they can be dangerous to be around, making them highly volatile to work related injuries if left in a open area. Current regulations require industrial robots to be caged and heavily monitored to prevent safety disasters.
- Another issue is that complete machine replacements don't happen often which can cause older robots to become worn down and not spatially optimized.
- To overcome these drawbacks, next-generation industrial robotics are equipped with artificial intelligence and advanced sensing and perception systems that allow for uncaged operation.

Conclusion

Energy efficiency in robotics has been improved by hhardware and/or software improvements such as selecting proper hardware, and improving movement paths. For the future, it can be expected that only improvements to industrial robotics will happen and continue to be more energy efficient. Next-Generation industrial robotics are compact and equipped with artificial intelligence and advanced sensing systems to improve energy efficiency.

Cited References

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- Pictures in this poster were taken at Chattanooga State Community College, Chattanooga, TN