Reaction Time Difference Electric Actuator and Pneumatic Actuator Using Simulation X program

Abdullah Hawari

Abstract

Electric actuator and pneumatic actuator have some difference in the system, but need to find which one that have better efficiency and applicable on the designed system. Comparing two different system is not an easy task, need to find the right variable to be compared to define which one is more applicable. Reaction time is one of the variable determined by the velocity and the distance reached by the actuator to find which one is applicable. Using simulation X 3.3 to take the simulation on the pneumatics and the electronics using another parameter to find the reaction time of each system.

Keyword : Pneumatic; Actuator; Simulation X3.3

1. Introduction

Actuator is a type of motor that is responsible for moving or controlling mechanical system using source of energy, electric current, hydraulic fluids or compressed gas. There is also two types of movement that can be done by actuator the first is reciprocating move and the second one is rotary move. Commonly in industry commonly used actuator is hydraulic and pneumatic type. In this modern time when a company insist to have efficiency as high as possible. Hydraulic and pneumatic actuator have so many energy loses because of their energy source and phase change, in the other hand electric cylinder have higher efficiency because have fewer phase change.

2. Pneumatic Cylinder

Pneumatic cylinder are mechanical devices which use the power of compressed gas to produce a linear reciprocating force. Because the operating fluid is a gas, the leakage will not drip out and contaminate the surroundings, making pneumatics more attractive where cleanliness is a necessity. The challenges are created by the properties of the working liquid (compacted air): high compressibility and low consistency.

Speed and position are strongly related: an accurate positioning can be achieved only if a rigorous control of the actuated load speed exists\textsuperscript{[1]}. Normally the control of the velocity is accomplished by incorporating a relative pneumatic stream controller (corresponding throttle or a relative directional control valve) inside the structure of the framework. The last form rearranges the structure of the framework, halting the heap in the modified focuses by hindering the weight supply circuits of the dynamic councils of the pneumatic engine. Because the pneumatic actuator work low pressure, when there is pressure loss, even only a little will cause a big loss on performance,
one of the treat of power loss is by infected by unwanted object. Unwanted object can cause power loss because it can damage the seal, rod and tube in actuator and make internal leaking.

3. Electric Cylinder

Electric cylinder is an actuator (cylindrical shaped) assisted by a motor to drive aligned worm gear to gain reciprocating movement. Typically, an electric motor is mechanically connected to rotate a lead screw. A lead screw has a constant helical string machined on its circuit running along the length (like the string on a fastener). Strung onto the lead screw is a lead nut or ball nut with relating helical strings. The nut is kept from turning with the lead screw (normally the nut interlocks with a non-pivoting part of the actuator body). Subsequently, when the lead screw is turned, the nut will be driven along the strings. The direction of motion of the nut depends on the heading of pivot of the lead screw. By associating linkages to the nut, the movement can be changed over to usable straight uprooting. Most current actuators are built for high speed, high force, or a compromise between the two. While considering an actuator for a specific application, the most vital particulars are regularly travel, speed, power, exactness, and lifetime.

There are many types of motors that can be used in a linear actuator system. These incorporate dc brush, dc brushless, stepper, or at times, even instigation engines. Everything relies on upon the application prerequisites and the heaps the actuator is intended to move. For instance, a straight actuator utilizing a basic pull AC motor driving a lead screw can be utilized to work a vast valve in a refinery. In this case, accuracy and high movement resolution aren't needed, but high force and speed are. For electromechanical linear actuators used in research center instrumentation mechanical autonomy, optical and laser hardware, or X-Y tables, fine resolution in the micron range and high precision may require the use of a fractional horsepower stepper motor linear actuator with a fine pitch lead screw. There are numerous varieties in the electromechanical direct actuator system. It is basic to comprehend the outline prerequisites and application imperatives to know which one would be ideal.

![Fig 2.2 Electric Actuator](image-url)
4. Simulation X

Using simulation X 3.3 we put on the parameter of the pneumatic and electric actuator, the problem with the simulation is we need to calculate all the variable first, we can’t just put the type of the seal we need to directly put the friction of the seal that may be make the result inaccurate, also it’s hard to determine the system for the electric actuator so make the simulation not completely done.

5. Simulation Result

![Fig 1.4 Velocity of Pneumatics](image)

![Fig 1.5 Distance Result Pneumatics](image)

6. Conclusion

We find the time of the pneumatics to reach is full stroke is near 2 seconds, with the maximum velocity is 80 mm/s. Because we can’t quite simulate the electric actuator properly we need to determine the speed of the electric actuator based on the
specification. As long it can achieve 151 mm of displacement on 2 seconds it can be
determine that have same reaction time as the pneumatics one.

References

Approximate Magnetic Characteristic, 1-6
3. Takahashi, Daiki (2016). Bilateral control of a velocity control system using electric and hydraulic
actuators, 1-2
actuators based on stroke requirements, 1-2
5. Liu, Yongguang (2015). Research of control strategy in the large electric cylinder position servo
system, 1-7