Control systems essay example

[Engineering](), [Aviation]()

Part 1

The advantages of top-down approach to engineering problems

A top-down approach is also known as the stepwise design and in most some cases; it is used as a synonym of decomposition. It is essentially the breaking down of a system in order to gain insights into its compositional and elemental sub-systems or sub-groups. In this approach, a brief or detailed overview of the system is formulated and specifying but does not detail any of the first-level sub-systems. Each sub-system is then defined and refined in yet greater detail, and sometimes in many additional sub-system levels, till the entire specification is reduced to the primary elements and sub-sets. This kind of model is often specified with the assistance of " black boxes", which make it easier to be manipulated and hence making easy the design process. However, black boxes may fail to elucidate the elementary mechanisms or fail to be detailed enough in order to realistically validate the model. This top down approach begins with the big picture and then breaks down from there into smaller segments and sub-groups.

There are two paradigms of organizations with regards to engineering design. They include the top-down and bottom-up approaches. A lot of both planning and research marks the top-down approach. These would then lead to the development of the product under consideration. Maintaining the goal for the product, the assembly of the product is done on a system-wise basis. This is called structured control. On the other hand, the bottom-up approach tends to be more of experiment-oriented. First, the top-down approach is advantageous when the Product Concept Design Cycle is lightly experimental and also when the product is not something which is completely new. Secondly, when the project being carried out is under tight budget; this would ensure that maximum savings are realized by thoroughly planning for the budget at the commencement of the design cycle. Thirdly, when building a large complex system, like a machine, normally needs to be broken down into smaller manageable problems that can be easily solved. For this reason, top-down approach would become very instrumental. Furthermore, top-down approach does not require too many voices or hands to partake of the project. This would not only save time required for the completion of the project but it would also give room for one to think creatively into ways of solving the problem at hand.

Part 2

Ball Screw Linear Actuator

There are many uses that linear ball screw-type actuators have been used. Some of the operations that they have been used include the transmission of linear motion when performing some actions like opening and closing, raising and lowering, advancing at the same time retracting, and the positioning process of many devices. One of the examples of actuators that are used for such actions include a screw that is axially restrained which has been supported so that it will rotate as it is driven by motor. There is the carrying of a ball nut which is on the screw where there is the formation of the same on the groove. The groove will match with the helical groove which has been formed on the screw so that it is able to accommodate one more or more raceway circuits that are characterized with recirculating load bearing balls. There is an inner tube which is received in the outer tube where it is fixed to the ball nut. In this process, the inner tube will fix a clevis at the end of the connection with the device that is to be connected. In the process where the screw turns, the ball nut will turn the rotation of the motion of the screw into the equivalent motion of the linear tube. For this to be achieved, the ball has to be restrained while it is rotating.

In the typical aspect, the members of the outer and inner tube have undergone cylindrical tubing. At the present, there is nothing that has been constructed that will be used to restraining the inner tube members. It means that there is nothing that has been constructed to restrain the rotation. In most cases, this does not result to any problem because most actuators get the restraining from the restrained against rotation by the attachment that they have with the device that is being actuated. This means that the inner tube will not get the restraining from rotation from the outer tube. It is because the device with which it has been attached will act to restrain the inner tube from rotating.

There are some situation where the attached device is not able to provide the restraining that is needed in the entire process. An example of this case is when the inner tube is to be attached to a flexible chain or cable. It is because such devices are known to rotate and twist with the inner device. It is the case at the positions where the inner tube has extensions and retractions. In cases where such actions can be objective, the approach that has been selected in the past is to have actuators which are non-lead or to have actuators whose type of lead screw. In this case, the telescoping members are fabricated of square rather than having the cylindrical tubing. This solution has added to the cost, weight and the complexity of the actuator.

Methodology for speed and position control of a ball screw linear actuator

Actuators are commonly used as structural members. Specifically, in addition to moving one element relative to another, they are used to maintain a particular position once it has been achieved. Should the actuator be removed or certain actuation components fail, the two elements would be free to move with respect to each other. An actuator failure would permit the rotor to swing free with respect to the wing of the aircraft. This would normally result in the loss of the aircraft. This type of failure could result in the aircraft rotor changing its position relative to the wing at a very rapid rate; this could result in structural failures of various aircraft components. Should an aircraft structural failure not result, the aircraft rotor would be in a free swinging position with respect to the remainder of the aircraft. This could result in dynamic instabilities which could result in loss of control of the aircraft. In view of these considerations an actuator for this particular purpose must function with a high degree of reliability. The actuator of the present invention has been so designed. The basic manner in which the present invention overcomes the aforementioned difficulties is by mounting a pair of drive mechanisms on a common track so as to provide dual redundancy. Each of the drive mechanisms includes a motor which operates a translating device in engagement with the track. The drive mechanisms move in opposite directions relative to each other on the track and are mounted such that there is a maximum distance between them when each is located at opposite end of the track and there is a minimum distance between them during normal operation when they are located at the track mid-point. The drive mechanisms are additionally equipped with a device which prevents each from riding free with respect to the track in the event of a structural failure or loss of power to the motor. This in effect locks one of the drive mechanisms with respect to the track while actuation is still provided through the other mechanism. As a further safeguard, a transmission shaft may connect the two drive mechanisms. The shaft permits the motor of one of the drive mechanisms to operate the second drive mechanism in the event the motor associated with the second drive mechanism fails. This serves to provide an operable actuator in the event there are certain double failures within the system. In addition, the shaft acts to synchronize the two drive mechanisms. Should an aircraft structural failure not result, the aircraft rotor would be in a free swinging position with respect to the remainder of the aircraft. This could result in dynamic instabilities which could result in loss of control of the aircraft. In view of these considerations an actuator for this particular purpose must function with a high degree of reliability. In the typical aspect, the members of the outer and inner tube have undergone cylindrical tubing. At the present, there is nothing that has been constructed that will be used to restraining the inner tube members. It means that there is nothing that has been constructed to restrain the rotation. In most cases, this does not result to any problem because most actuators get the restraining from the restrained against rotation by the attachment that they have with the device that is being actuated. This means that the inner tube will not get the restraining from rotation from the outer tube. It is because the device with which it has been attached will act to restrain the inner tube from rotating.

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Analysis and discussion of the relative merits of the ball screw linear actuator when compared to pneumatic and hydraulic cylinders

One thing that has been recognized in surface control for aircraft is that failure mode of an aircraft can cause jammining problems which can result in adverse problems. These issues will cuase the system to have many problems in the long run. When there are system failures, especially failures that are caused by extreme voltage can cause the command signal to actuate. It is dangerous to the safety of the flight and can be detrimental in the long run. The role of actuators is to control the surface of such devices as rudders, stabilizers (horizontal) and ailerons. In the traditional aspects of aircraft control systems, there has been the use of hydro-mechanical actuation systems. These hydro-mechanical actuation systems have been relied upon because of non-jamming features. These are the features that enables Actuators move or control such control surfaces as rudders, horizontal stabilizers, ailerons, and the like. In most cases, this does not result to any problem because most actuators get the restraining from the restrained against rotation by the attachment that they have with the device that is being actuated. This means that the inner tube will not get the restraining from rotation from the outer tube. It is because the device with which it has been attached will act to restrain the inner tube from rotating.

Part 3

The importance of a designer of a PLC program to understand the use of a register for inputs, outputs, and internal program components

In the diagram that is shown as ladder, the representation of all the inputs is given as symbols and the outputs have been represented as coil symbols. There is also the association with some numbers which have been shown to be the address. These " address" numbers reference the location of the external input/output connections either to the PLC or to the internal relay equivalent address within the PLC.

References

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