Solving Pervasive Valve Fluctuations

By Chris Warnett
Recent technological advances in the design and manufacturing of electric control valve actuators are making it possible for users to gain unprecedented levels of process stability, energy savings and responsiveness not available in the past. ?

This new generation of control valve actuators represents a major step forward in the evolution of control valve technology. The capabilities of these new actuators promise to help improve the efficiency of challenging processes, lower maintenance expenses and even reduce compressed air supply costs.

Various valves are used to accommodate a similar range of diverse media (as well as assorted media conditions). More specifically, many applications requiring chemical engineering expertise involve media that challenge traditional control valves and actuators. For example, some liquids may be extremely viscous or form deposits on the closure element of the valve, making precise valve operation difficult for traditional equipment.

Pervasive Slip-Stick Problem

The traditional method of moving control valves to their desired positions has been through a pneumatic actuator. These actuators often come in the form of spring-opposed diaphragm or piston devices controlled by a conventional or smart positioner.

Because pneumatic systems are resilient, they often provide a challenge in the chemical industry. Valves that control the flow of viscous or otherwise difficult media often require increased air pressure to initiate motion. The additional air builds up in the actuator diaphragm until the valve breaks free of the static friction.

Once the valve starts moving, static friction resistance is replaced by dynamic friction. The dynamic friction force is usually significantly less than the static friction, and the valve often overshoots the desired position or controller set point.

The resulting stick-slip action causes undesired fluctuations in the process variable. Such fluctuations can cause significant negative effects to the desired specification of the product being manufactured. Furthermore, fluctuations in the process variable mean that the plant’s capacity cannot be optimized to produce the maximum amount of product.

Many positioner manufacturers have invested resources to develop pneumatic positioners that can reduce the stick-slip effect. However, it is hard to eliminate completely because air, which is the power medium, stores energy when it is compressed. That energy has to dissipate somewhere once the opposing force is reduced, and excess movement is the only outlet for it.

The obvious solution to this problem is to provide an actuator for the valve that is impervious to stick-slip action in the valve. The solution requires an actuator that has sufficient resources of power to draw upon, yet can control the power precisely so that as soon as the movement is initiated, it can be attenuated to preclude unwanted movement.

Today's Technology

Electric actuators are capable of providing such control. However, until recently electric motors could not be controlled rapidly enough to produce the desired effect. Today, that has changed. In fact, several developments have occurred that enable electric motors to be controlled to such a high responsiveness that the stick-slip problem can be eliminated.

These advances include the development of sensors that are highly accurate combined with control processors that are extremely fast at computing the complex control algorithms required. Despite the proven effectiveness of these advances, there are probably some who hold to the notion that electric actuators are only useful for infrequent operation on isolating valves.

But, the answer to that objection is found in the careful selection of gearing materials, design and technology. Specifically, high-efficiency gearing can provide the almost constant movement required by a process control valve. These gear assemblies adequately provide for the millions of cycles needed for reliable process control usage.

Others may be reluctant to accept the concept of electric control valve actuators because they like the simplicity of design and control offered by pneumatic actuators, which typically use a spring-opposed configuration. That configuration, however, inherently provides a failure position should the air supply fail.

While in the past it was difficult to render a practical fail-safe mechanism for an electric actuator, new technology has been developed for hybrid- and fuel cell-driven automobiles that enables stored electricity in super-capacitors to be used to power actuators in emergencies. These devices allow at least one stroke of emergency operation under full load and have already proven they are a dependable method of fail-safe operation.

This now means that for certain applications in which the stick-slip effect in the valve causes problems in the production process, an electric actuator is the ideal solution. The new-generation actuators can resolve the problem with the benefit of increasing plant capacity and improving product quality. In fact, the cost savings accrued can often eclipse the cost of the replacement actuator in a few operating days. n

Chris Warnett is a sales and marketing director at Rotork Process Controls, Rochester, NY. More information is available by contacting Warnett at 585.247.2304 or chris.warnett@rotork.com, or by visiting ?www.rotorkprocesscontrols.com. ???