by Jesse Yoder, Ph.D.

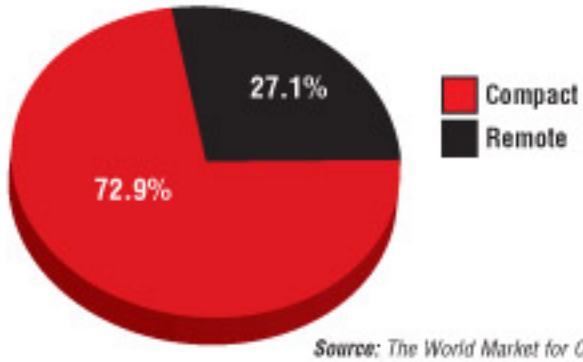
Addressing Cost & Line-Size Limitations

Principle of Operation: Coriolis flowmeters are composed of one or more vibrating tubes, usually bent. The fluid to be measured passes through the vibrating tubes, accelerating as it passes towards the point of maximum vibration and decelerating as it leaves this point. The result is a twisting motion in the tubes. The degree of twisting motion is directly proportional to mass flow. Position detectors sense the positions of the tubes. While most Coriolis flowmeter tubes are bent and a variety of designs are available, some manufacturers have also introduced straight-tube Coriolis flowmeters.

It is often said that Coriolis meters measure mass flow "directly," unlike other flowmeters that calculate mass flow by using an inferred density value. Volumetric flow (Q) is calculated by multiplying the cross-sectional area of a pipe times the average fluid velocity. Mass flow is determined by multiplying volumetric flow (Q) times the density of the fluid. Some multivariable flowmeters measure the pressure and temperature of the process fluid, and then use these values to infer fluid density. Mass flow can then be calculated.

Technology & Market Trends: Suppliers have made a number of improvements in Coriolis technology over the past five years. Coriolis meters are now much better able to measure gases than they were previously. The majority of Coriolis suppliers now have meters that can measure gas flow. Straight-tube meters have become more accurate and reliable, thereby addressing some of the drawbacks of bent-tube meters. These include pressure drop, the ability to measure high-speed fluids, and the tendency of bent tubes to impede the progress of fluids. And both Micro Motion (*www.micromotion.com*) and Endress+Hauser (*www.us.endress.com*) have broken the price barrier, offering Coriolis meters for considerably lower prices than were previously available.

Shipments of Coriolis Flowmeters in North America by Mounting Type in 2008 (Percent of Dollars)



Source: *The World Market for Coriolis Flowmeters, 3rd Edition, published by Flow Research Inc.*

More than any other meter, Coriolis meters have line size limitations. Due to the nature of the technology, Coriolis meters get large and unwieldy once they reach the six-inch size. Even two-inch, three-inch and four-inch meters are quite large. However, some companies are now making Coriolis flowmeters available in line sizes above six inches. These include Rheonik (now part of GE Sensing & Inspection Technologies, *www.gesensinginspection.com*), Endress+Hauser, and Micro Motion.

Straight-tube Coriolis flowmeters were first introduced in 1994, and since that time they have become more popular. Straight-tube meters address the problem of pressure drop because the fluid does not have to travel around a bend. This makes them better able to handle high-velocity fluids. Straight-tube meters can be drained more easily, which is important for sanitary applications. Liquids do not have a bend or curve that is prone to residue buildup. Straight-tube meters also have a more compact design, as bent tube meters can be quite large and unwieldy, especially in the larger sizes. Having a more compact meter can be an advantage where space is a concern.

News & Notes: GE Sensing & Inspection Technologies completed its acquisition of Rheonik in February 2008. Rheonik, based in Germany, has long been known as a supplier of large line size Coriolis flowmeters, namely six inches and up. GE Sensing had previously (in 2002) acquired Panametrics to become a significant player in the ultrasonic flowmeter market.

In October 2008, KROHNE (*www.krohne.com*) launched its corrosion-resistant Tantalum version of its OPTIMASS 7300 Coriolis mass flowmeter. This meter is designed to handle the highly aggressive and corrosive fluids found in the chemical industry. The Tantalum has a straight-tube design. Micro Motion unveiled its first two-wire Coriolis flowmeter in September 2008. The new transmitter is called the Model 2200S, and it can be used with a variety of Elite Coriolis sensor tubes.

***Jesse Yoder**, Ph.D., is president of Flow Research, Inc. in Wakefield, Mass., a company he founded in 1998. For more on Flow Research's coverage of Coriolis flowmeters, visit* **www.flowcoriolis.com**.