Ultrasonic flowmeters wow them at CEESI Workshop

By Jesse Yoder, Ph.D.

One of the most notable annual events in the flowmeter world is the Colorado Engineering Experiment Station, Inc. (CEESI) Ultrasonic Meter Workshop. The first was held in Clear Lake, Iowa, in 2001 and drew 37 attendees. In 2013, the conference was in Denver, with more than 180 participants. The workshops bring together market decision-makers and theorists in the ultrasonic flowmeter community, along with end-users, to discuss key topics related to products and applications.

Ultrasonic-flowmeter technology is certainly worthy of its own annual conference. Other flowmeter workshops include the International North Sea Flow Measurement Workshop, focused on topics related to oil and gas measurement, including multiphase flow, allocation metering, and measurement of liquefied natural gas (LNG) and liquefied petroleum gas (LPG). It's happening Oct. 22-25 in Tønsberg, Norway.

Another important conference is FLOMEKO, held this year in Paris, Sept. 24-26. FLOMEKO isn't devoted to a specific technology; instead, it deals with a variety of theoretical and practical issues related to flow metering. This year's is its 16th occurrence, with attendees expected from over 25 countries.

Topics and context

Attendees went to CEESI USM to talk about gas-flow measurement, including for wet gas, flare stack and high CO_2. The future of AGA-9 was discussed and other topics included provers for ultrasonic meters, quality-assurance programs, monitoring systems and ultrasonic-meter calibration. There were presentations on clamp-on meters, as well as multipath ultrasonic meters.

Ultrasonic flowmeters were introduced commercially by Tokyo Keiki in 1963, and in the United States in the early 1970s by Controlotron (now owned by Siemens). Its ultrasonic meters were of the clamp-on variety. In the early 1980s, both Panametrics and Ultraflux experimented with ultrasonic meters for gas-flow measurement. In the mid-1990s, a group called Group Europeen de Recherches Gaziers (GERG) published a technical monograph on ultrasonic flowmeters for gas flow measurement. A monograph out of GERG led to increased European ultrasonic flowmeter use from 1996-1999.

The GERG monograph laid the groundwork for the publication of AGA-9 by the American Gas Association. AGA-9 lays out criteria for using ultrasonic flowmeters for custody-transfer applications. Since its publication in June 1998, ultrasonic flowmeters have become widely used for custody transfer of natural gas. They are especially suited for measuring gas flow in large pipelines, easily handling flow in those above 20 inches in diameter, as well as smaller pipelines. Its main competitors for custody transfer of natural gas are the differential-pressure (DP) orifice meter and turbine flowmeter.

It used to be standard practice to divide the ultrasonic flowmeter market up according to whether the meters are transit-time, Doppler or hybrid. Traditional use of transit-time meters was to clean liquids, while Doppler meters handle fluids with impurities. Hybrid meters are a combination of transit-time and Doppler, and use one technology or the other, depending on the fluid.

The past 10 years, transit-time suppliers made great progress getting transit-time meters to measure fluid flows with some impurities. As a result, Doppler and hybrid meters are less important, since transit-time meters are now used for applications previously reserved for Doppler meters. Another reason for growth in transit-time meters is their use in energy industries, mainly oil and gas, within which Doppler flowmeters play no major role.

Mounting-type classification

Mounting type is now the more useful way to classify ultrasonic flowmeters, rather than transit time vs. Doppler. Three main mounting types for ultrasonic flowmeters include:

- Clamp-on
- Insertion
- Inline

Clamp-on meters were most popular in the early days of ultrasonic flowmeters. They have some important advantages. Because they clamp on the outside of the pipe to send a signal through the pipe

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fluid to a receiver, clamp-on meters are portable and do not impede flow. Hence, no pressure drop. They often are used as check meters to verify the performance of other in-line flowmeters.

Clamp-on meter disadvantages limit their usefulness in certain situations. The ultrasonic signal can be attenuated by the pipe wall. Knowing pipe-wall thickness and composition can be important. In addition, build-up on the inside of the pipe wall can affect the internal diameter of the pipe. Knowing the internal pipe diameter is important to getting a correct flowmeter reading.

Insertion meters are sometimes used in large pipes when a spool-piece would be expensive. They have a cost-advantage over inline meters, since there is no meter body. Insertion meters go into a hole drilled in the pipe wall. They are widely used in stack-gas and exhaust-flow monitoring. Here they compete with DP flowmeters using averaging Pitot tubes and with thermal flowmeters.

Inline ultrasonic flowmeters are mounted with a meter body in the pipe. Inline meters achieve the highest accuracy of any ultrasonic meters, and multipath ultrasonic meters are inline meters. Multipath meters have three or more ultrasonic signals or "paths" to determine flow velocity. This gives them greater accuracy than single- and dual-path meters. The most common number of paths is four, five and six, but some multi-path meters have eight, 12 or even 18 paths. Inline meters are used for custody-transfer applications.

Recalibration an issue

A final issue from the CEESI USM discussion was how often ultrasonic flowmeters should be recalibrated. This is important to end-users, especially those doing custody transfer, since they must be certain meters read correctly. The AGA seems not to be taking on this issue. Flow Research is working with Tom Kegel of CEESI to find resolution, and we welcome any comments.

Take advantage of future CEESI Ultrasonic Meter Workshops. CEESI plans a similar conference in Portugal April 22-24, 2014, The European Hydrocarbon Measurement Conference: Ultrasonic and Coriolis Metering. CEESI is expanding the conference scope to cover the fast-growing Coriolis flowmeter market. The next CEESI Ultrasonic Meter Workshop is scheduled for July 14-17, 2014 in Denver.

Jesse Yoder, Ph.D., is president of Flow Research, Inc., a company he founded in 1998. He has 26 years of experience as an analyst and writer in process control. Dr. Yoder specializes in flowmeters and other field devices, including pressure, level and temperature products. He has written over 150 market research studies in industrial automation and process control and has published over 200 journal articles. He recently authored Volume X: The World Market for Flowmeters, 4th Edition (www.flowevery-thing.com).