Manual of Petroleum Measurement Standards Chapter 4.6

Pulse Interpolation

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Suggested revisions are invited and should be submitted to the Standards Department, API, 200 Massachusetts Avenue, Suite 1100, Washington, DC 20001, standards@api.org.

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Introduction

To prove meters that have pulsed outputs, a minimum number of pulses has to be collected during the proving period, depending on the user's chosen meter technology. Limits on prover volume or the number of pulses that a flowmeter can produce per unit quantity of throughput can limit design considerations.

The electronic signal from a flowmeter allows for interpolation between adjacent pulses. The technique of improving the discrimination of a flowmeter's output is known as pulse interpolation. Although pulse interpolation techniques were originally intended for use with small volume provers, they can also be applied to other proving devices. Pulse interpolation, though a mathematical technique, relies on the underlying and contributing uncertainty of the prover detector signal. Potential users are cautioned that use of the technique absent the requisite accuracy can produce misleading results.

The pulse interpolation method known as double-chronometry, described in this chapter, is an established technique used in proving flowmeters. As other methods of pulse interpolation become accepted industry practice, they should receive equal consideration, provided that they can meet the established verification tests and specifications described in this publication.

Pulse Interpolation

1 Scope

This chapter describes how the double-chronometry method of pulse interpolation, including system operating requirements and equipment testing, is applied to meter proving.

2 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For undated references, the latest edition of the reference document (including any amendments) applies.

API *MPMS* Chapter 4.2, *Displacement Provers*

3 Terms and Definitions

For the purposes of this document, the following terms and definitions apply. Terms of more general use may be found in the API *MPMS* Chapter 1, *Online Terms and Definitions Database*. Acronyms are defined in the text at first use.

3.1
detector signal
A contact closure change or other signal that starts or stops a prover counter or timer and defines the calibrated volume of the prover.

3.2
double-chronometry (dual chronometry)
A pulse interpolation technique used to increase the discrimination level of flowmeter pulses detected between prover detector signals. This is accomplished by resolving these pulses into a whole number of pulses plus a fractional part of a pulse using two high-speed timers, associated logic, detector signals, and the flowmeter pulses.

3.3
flowmeter discrimination
A measure of the smallest increment of change in the pulses per unit of the quantity being measured.

3.4
frequency
The number of repetitions, or cycles, of a periodic signal (e.g., pulses, alternating voltage, or current) occurring in a 1-second time period. The number of repetitions, or cycles, that occur in a 1-second period is expressed in hertz.

3.5
meter pulse continuity
The deviation of the interpulse period of a flowmeter expressed as a percentage of a full pulse period.

3.6
nonrotating meter
Any metering device for which the meter pulse output is not derived from mechanical rotation as driven by the flowing stream. For example, vortex shedding, Venturi tubes, orifice plates, sonic nozzles, ultrasonic, direct mass flow meters (Coriolis), and electromagnetic flowmeters are metering devices for which the output is derived from some characteristic other than rotation that is proportional to flow rate.