

RICHARD C. AIKEN, MD, PhD

Real-Time Transient Flow Modeling · Two-Phase Flow Measurement · CO₂ Transport & Acid-Gas Chemistry
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Independent consultant and researcher working at a three-way intersection rarely occupied by one person: **numerical methods for stiff dynamic systems**, **field measurement of two-phase pipeline flow**, and **CO₂/acid-gas process chemistry**. I help operators, metering vendors, and research organizations build real-time, physics-based monitoring and prediction for multiphase and CO₂ pipelines — models fast enough for the control room and honest enough to say when they should not be trusted.

CORE CAPABILITIES

- **Real-time transient modeling & virtual flow metering.** Runtime-certified reduced-order methods for stiff pipeline dynamics: slug and transient forecasting with bounded computational cost and an in-line validity diagnostic (composite asymptotic estimator; manuscript under journal review, 2026). Continuous model recalibration against sparse pressure/temperature sensors, building on my stage-wise parameter estimation for stiff differential equations (AIChE J., 1986).
- **Two-phase pipeline flow measurement — field heritage.** Founder and CEO of Digitron, Inc. (1983–1993), which designed and operated gamma-ray flow-regime measurement systems on offshore and hilly-terrain gas-condensate pipelines for Shell, Mobil, and Standard Oil of California (Chevron). Author of AGA research publications including Field Observations of Two-Phase Flow in the Matagorda Offshore Pipeline System (1986) and Two-Phase Flow Measurement of the Rickman-Painter System (1985); presented “Two-Phase Flow in Hilly Terrain Pipelines” to the AGA in 1983, anticipating what later became a major research subfield.
- **CO₂ transport and acid-gas chemistry.** Refereed publications on selective H₂S removal from CO₂ streams and high-pressure selective gas purification (AIChE J., Chem. Eng. Sci., Fuel Processing Technology) — directly relevant to impurity effects, phase behavior, and measurement in CCUS pipeline transport.
- **Criterion-based stability, safety, and control analysis.** Author of the graded damping-factor criterion for explosion limits (Combustion and Flame, 1982, H₂-O₂ kinetics; U.S. Air Force sponsored) — perturbation-derived go/no-go criteria of the same family as decompression/fracture-control analyses for CO₂ and hydrogen pipelines — and of early event-triggered (“wait-and-see”) process control under uncertainty (ISA-79).
- **Instrument measurement models and diagnostics (not hardware development).** Treats meters, densitometers, and analyzers at the interface layer — measurement equation, uncertainty structure, dynamic response, and failure signatures — feeding rigorous inference and self-validating diagnostics. Gamma-transmission measurement models come from firsthand practice (former industrial licensee, multi-curie Cs-137 field systems) reinforced by three decades of clinical imaging; advises on nuclear vs. non-nuclear metering strategy at the measurement-model level.

SELECTED CREDENTIALS

PhD, Princeton University (numerical integration of stiff systems, with Leon Lapidus). Editor, *Stiff Computation* (Oxford University Press). Tenured Associate Professor of Chemical Engineering, University of Utah. Consultant to NASA Johnson Space Center (tethered satellite dynamics, STS-75) and to the defense sector (energetic materials). MD, board-certified; retired May 2026 as Chief of Medicine of a hospital system after a 30-year clinical career — now returned full attention to flow physics and computation.

ENGAGEMENT TYPES

Technical consulting and algorithm development · advisory roles with metering vendors, digital-twin/VFM developers, and JIPs · CCUS measurement strategy · independent expert review and expert-witness work · lecturing and training.