

# The Tao of Measurement

Synopsis of Book: This book develops the theory of measurement of some of the most important and commonly measured variables. The approach of the book is both historical and theoretical. It looks at different measurement instruments and tools that have been developed for measuring common variables, and explains the theory behind them. It then uses the theory developed to talk about current and future developments in measurement for the particular variable being discussed.

This book looks at the following variables, and the tools and instruments used to measure them:

- Flow
- Pressure
- Temperature
- Time
- Length
- Area


After examining the above variables, the book uses the discussion on these variables to develop a more general theory of sensors and measurement. It concludes with a look ahead to the future of measurement.

The following is a proposed outline and synopsis of the chapters in **The Tao of Measurement**.

Foreward - by Morley

## Chapter One: Overview

1. Why
  - a. Why the book?
  - b. Why the authors?
  - c. Why sensing and measurement?
2. Physics and reality
  - a. Observer is key
  - b. Philosophy
    - (1). Observer
    - (2). Risk
    - (3). Scale
    - (4). Bias and misconceptions
      - (a) Loosely Coupled Sets
  - c. Physics and measurement
3. Dimensions

- a. Of Morley
  - (1) Time
  - (2). Mass
  - (3). Space
    - (a) Length
    - (b) The big five
    - (c) Space-time
  - (4). Forces
    - (a) The big four
  - (5). Chaos and butterflies
  - (6). Energy/Mass
  - (7). Quantum Mechanics
- b. Of Engineers
  - (1) Length
  - (2). Mass
  - (3). Time
  - (4). Current
  - (5). Temperature
  - (6). Luminosity
  - (7). Amount
- c. The soft ones
  - (1). Comfort
  - (2). Temperature
  - (3). Flow
  - (4). Radiance
  - (5). Humidity
  - (6). Oxygen/co etc.
  - (7). Odor
  - (8). Mental (security)
  - (9). Noise
  - (10). Control
  - (11). View
  - (12). Lighting - color and temperature
  - (13). Furniture
  - (14). Resources
  - (15). Intrusion
  - (16). Habit
  - (17). Expectations
  - (18). Communications
  - (19). Coffee
  - (20). Facilities
- d. Of process and control
  -  Pressure
  - (2). Time
  - (3). Length

#### (4). Area

### **Chapter Two: Temperature Measurement**

1. Overview
2. What is Temperature?
3. Temperature Measurement
4. History of Temperature Measurement
5. Liquid in Glass Thermometers
6. Thermocouples
7. Resistance Temperature Detectors
8. Thermistors
9. Infrared
10. Applications
11. The Future of Temperature Measurement
12. Morley's Take

### **Chapter Three: Pressure Measurement**

1. Overview
2. What is Pressure?
3. Pressure Measurement
4. History of Pressure Measurement
5. Pressure Sensing Technologies
  - a. Piezoresistive
  - b. Capacitive
  - c. Other
6. Pressure Transducers
7. Pressure Transmitters
8. Applications
9. The Future of Pressure Measurement
10. Morley's Take

### **Chapter Four: Flow Measurement**

1. Overview
2. What is Flow?
3. Flow Measurement
4. History of Flow Measurement
5. Traditional Technology Flowmeters
  - a. Differential Pressure (DP) Flowmeters and Primary Elements

- b. Positive Displacement Flowmeters
- c. Turbine Flowmeters
- d. Variable Area Flowmeters
- e. Open Channel Flowmeters
- 6. New-Technology Flowmeters
  - a. Coriolis
  - b. Magnetic
  - c. Ultrasonic
  - d. Vortex
  - e. Thermal
- 7. Emerging Technologies of Flow Measurement
  - a. Optical
  - b. Sonar
- 8. The Migration from Traditional Technology to New-Technology Flowmeters
- 9. Applications
- 10. The Future of Flow Measurement
- 11. Morley's Take

### **Chapter Five: Time Measurement**

- 1. Overview
- 2. What is Time?
- 3. Measurement of Time
- 4. History of Time Measurement
- 5. The Units of Time
- 6. Decimal Time
- 7. Flowtime: A Form of Decimal Time
- 8. Applications
- 9. The Future of Time Measurement
- 10. Morley's Take

### **Chapter Six: Length Measurement**

- 1. Overview
- 2. What is Length?
- 3. Measurement of Length
- 4. History of Length Measurement
- 5. Units of Length Measurement
  - a. Foot
  - b. Yard
  - c. Meter
  - d. Mile
- 6. Paradoxes of Length Measurement
  - a. Zeno's Paradox
  - b. What is a Line?
  - c. Do Points Have Area?

7. Applications
8. The Future of Length Measurement
9. Morley's Take

### **Chapter Seven: Area Measurement**

1. Overview
2. What is Area?
3. Measurement of Area
4. History of Area Measurement
5. Euclidean Geometry
6. A History of Pi
7. Circular Geometry
8. Do Circles Have Thickness?
9. The Diminishing Circle Argument
10. Applications
11. The Future of Area Measurement
12. Morley's Take

### **Chapter Eight: A Theory of Sensors, Transmitters, and Meters**

1. Overview
2. What is a Sensor?
3. Types of Sensors
  - a. Mechanical
  - b. Electronic
  - c. Biological and Human
4. What is a Transmitter?
5. Types of Transmitters
  - a. Flow Transmitters
  - b. Pressure Transmitters
  - c. Temperature Transmitters
6. What is a Meter?
7. Types of Meters
  - a. Flow Sensors and Flowmeters
  - b. Other Types of Meters
8. Artificial Intelligence
9. Robotics
10. The Human Mind as a Sensing System
11. Could Robots Ever Be Conscious?
12. Morley's Take

### **9. Chapter Nine: Measurement Futures and Speculation by Morley**

1. Pyramid of control

2. Physics
3. Futures in Measurement
4. Speculation

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