

Design of Measurement & Control Instruments

Chapter 3: Overall Design of Measurement & Control Instruments

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Motto



Ralph Waldo Emerson
(1803-1882)

"Enthusiasm is one of the most powerful engines of success. When you do a thing, do it with all your might. Put your whole soul into it. Stamp it with your own personality. Be active, be energetic, be enthusiastic and faithful and you will accomplish your object. Nothing great was ever achieved without enthusiasm."

--Ralph Waldo Emerson

Outline of Chapter 3

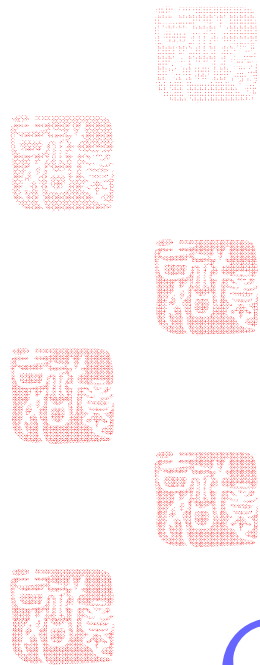
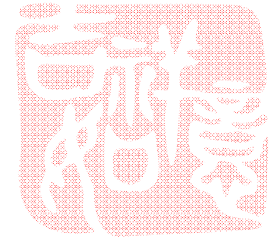
- ❑ Basic concepts
- ❑ Fundamental principles
- ❑ Selection of the operation principle and system design
- ❑ Determine the main structural parameters and technical specifications

Lectures Organization

- ❑ Lecture 1: *Introduction to Overall Design of Measurement and Control Instruments*
- ❑ Lecture 2: *Fundamental Principles*
- ❑ Lecture 3: *Select Operating Principle and System Design*
- ❑ Lecture 4: *Determine the main structure parameter and technical specifications*
- ❑ Summary
- ❑ Acknowledgement

Outline of Summary

- ❑ Involved Instruments and Measuring Tools
- ❑ Fundamental principles
- ❑ Acknowledgement

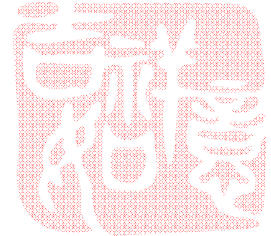


Involved Instruments and Measuring Tools (1/4)

- ❑ Universal Involute Measuring Machine (UIMM)
- ❑ Rotating Probe Roundness Measuring Machine
- ❑ Rotating Work-table Roundness Measuring Machine
- ❑ Opton三层结构式三坐标测头
- ❑ 套装式测微测头
- ❑ 三维激光扫描跟踪仪
- ❑ *Touch Trigger Probe*
- ❑ Abbe Length Measuring Machine
- ❑ Universal Length Measuring Machine
- ❑ Next Slide ...

Involved Instruments and Measuring Tools (2/4)

- ❑ 1m Projection length measuring machine
- ❑ Coordinate Measuring Machines
- ❑ *Universal Tool Microscope*
- ❑ *Laser 2D CMM*
- ❑ *C8-A Laser small angular measuring system*
- ❑ Straightness Measuring Machine
- ❑ *Optoelectronic Comparative measuring machine for Line Scales*
- ❑ *Dynamic measuring machine for screws*
- ❑ *Pressure transducer*
- ❑ *Next slide ...*



Involved Instruments and Measuring Tools (3/4)

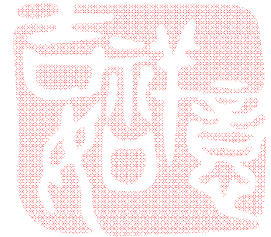
- ❑ Michelson Interferometer
- ❑ 1m *Laser Interference length measuring machine*
- ❑ Interference microscope
- ❑ The 50 metre interferometer bench at NWML
- ❑ Laser System Configuration on CMM
- ❑ Multiaxis System for a Precision x-y Stage
- ❑ Heterodyne-type Interferometer
- ❑ Dynamic Optoelectronic Microscope
- ❑ JCY Precision Angular Meter

Involved Instruments and Measuring Tools (4/4)

- ❑ 0.1" Grating Digital Dividing Head
- ❑ Universal Whole Tooth Error Measuring Machine
- ❑ Optical-Position Indicator
- ❑ Differential Capacitive Pressure Transmitter/Transducer

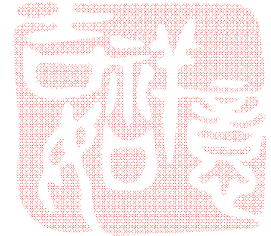
Fundamental Principles

- ❑ Occam's Razor
- ❑ Abbe's principle and its extension
- ❑ Min {Deformation}
- ❑ Comparative Measurement Principle
 - ✍ **Displacement Synchronized Comparative Measurement**
- ❑ Reading Averaging
- ❑ Compensating Principle
- ❑ Shortest Measuring Chain
- ❑ Unify the Coordinate System
- ❑ Next Slide...



Fundamental Principles

- ☐ Precision Matching Principle
- ☐ Economy Principle
- ☐ Saint-Venant's Principle
- ☐ Exact Constraint Design
- ☐ Centers-of-Action
- ☐ Elastic Averaging
- ☐ Minimize the Metrology Loop
- ☐ Separation of Metrology and Structural Loops
- ☐ Error Separation Techniques



Acknowledgement

*Thank you very much for
your attention!*

