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Basic Knowledge of Steam Turbine, ST-101/201 combined

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Target Audience:

This short curse is aimed at engineers, operations and maintenance personnel who need a broad-based introduction to mechanical drive steam turbine design, have a firm foundation in the basics associated with turbomachinery and mechanical engineering. This short course will provide the basic minimum knowledge of seam turbines from the design to the operation in half and more detail technical information, which will be useful design audit, trouble shooting, enhance participants, their own machines, how to approach in other half.

Description:

It is shown as the outline in this short course that the role of steam turbine, history, classification, basic structure, components and their function, manufacturing and design process and control system. And also, the basic thermal cycle, flow dynamics, strength analysis are explained as the academic knowledge. Finally, the trend of development and the state-of-the-art technology as the latest technical information and the typical root cause analysis as the example of troubleshooting are provided.

0. Introduction

1. Important role of steam turbine and history

1.1 Important role of steam turbine

1.2 Steam turbine development history

2. Classification of steam turbine

2.1 Classification for flow direction

2.2 Classification for driven rotating machines

2.3 Classification for steam condition

2.4 Classification for blade rows

0. Introduction

3. Overview and direction of steam turbine development

3.1 Trend in main steam condition

3.2 Trend in high efficiency design

3.3 Trend in high reliability design

4. Basic thermal cycle in terms of heat balance

4.1 Rankin cycle in system outline and h-s chart

4.2 Impact of steam inlet pressure, temperature and exhaust to efficiency

4.3 Theoretical internal thermal efficiency of turbine

4.4 Typical steam balance system of ethylene plant

0. Introduction

5. Basic structure, components and their function and manufacturing process of steam turbine

5.1 TTV

5.2 GV and ECV

5.3 Casing and internal parts

5.4 Rotor

5.5 Blades

5.6 Nozzle and diaphragm

5.7 Gland seal

5.8 Journal and thrust bearing

0. Introduction

6. Basic design flow

6.1 Overview of design flow chart

6.2 Turbine model selection

6.3 Performance and blade path design

6.4 Rotor dynamics

7. Flow dynamics of steam turbine

7.1 Typical steam flow in blade path

7.2 Flow around blade and velocity triangle

7.3 Overview of performance

7.4 Internal loss and flow

7.5 External loss and flow

0. Introduction

8. Basic blade design

8.1 Blade force evaluation as 1st approach

8.2 Beam model analysis as 2nd approach

8.3 Three dimensional (3-D) solid model analysis as 3rd approach

8.4 Rotating blade excitation test as 4th approach

9. Turbine control system

9.1 Control system overview

9.2 Speed control system

9.3 Extraction control system

9.4 Safety devices

9.5 Safety monitoring

0. Introduction

10. Technologies to improve performance and reliability

10.1 High inlet pressure and temperature steam turbine

10.2 High performance blade

10.3 Countermeasure for corrosion, erosion and fouling

10.4 Life time evaluation and diagnosis

10.5 Oil free control system

11. Particularity of mechanical drive steam turbine design

11.1 Variable speed control and power output characteristic

11.2 Blade design for variable speed

11.3 Rotor design for variable speed

11.4 International standards

0. Introduction

12. Typical RCA of steam turbine

12.1 Observation of blade failure on L-1 stage

12.2 Root cause analysis (Blade failure)

12.3 3D model analysis for blade strength

12.4 Fracture analysis of L-1 stage blade

12.5 Operating condition before blade failure

12.6 Quality check of condensate water

12.7 Blade material check of L-1 stage

12.8 Possible cause of L-1 stage blade failure

12.9 Countermeasure for L-1 blade failure

12.10 Lesson and learn

13. Drills and discussion