



Course Overview

I. Introduction

II. Two-dimensional steady conduction

- Analytical solution: The separation of variables method
- Numerical solution: Finite Difference (FD) and Finite Volume (FV)

Chapter 1

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Multi-dimensional conduction: Applications

Temperature distribution for thermal stress analysis

Combustor


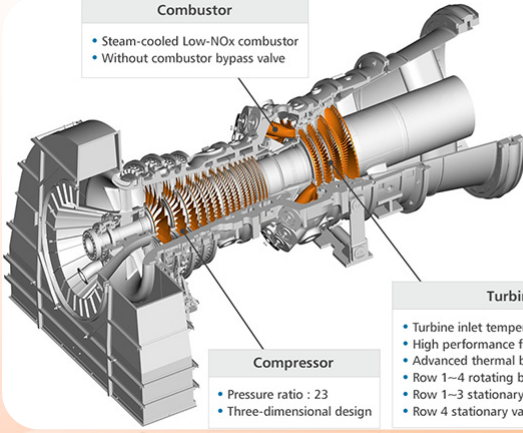
- Steam-cooled Low-NOx combustor
- Without combustor bypass valve

Turbine

- Turbine inlet temperature : 1600°C
- High performance film cooling
- Advanced thermal barrier coating
- Row 1~4 rotating blade : Air-cooled
- Row 1~3 stationary vane : Air-cooled
- Row 4 stationary vane : non-cooled

Compressor

- Pressure ratio : 23
- Three-dimensional design



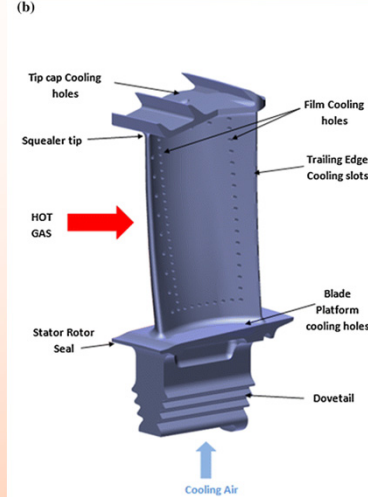
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(b)



Tip cap Cooling holes

Squealer tip

Film Cooling holes

Trailing Edge Cooling slots

Blade Platform cooling holes

Dovetail

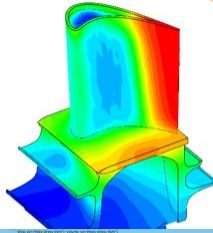
Stator Rotor Seal

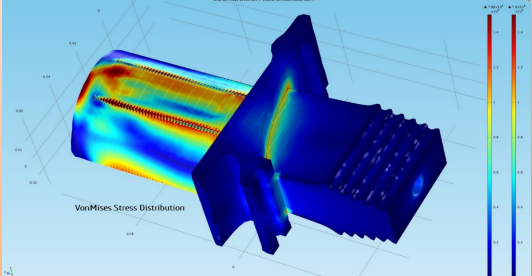
Cooling Air

HOT GAS

TEMP

1096.751
1053.554
1030.357
997.160
963.963
930.767
897.570
864.373
831.176
797.979
764.782
731.586
698.389
665.192
631.995
598.798
565.601
532.404
499.208
466.011
432.814
399.617
366.420





VonMises Stress Distribution

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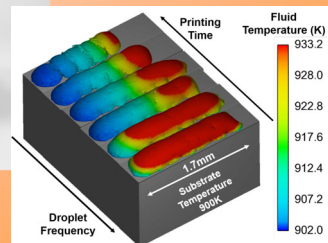
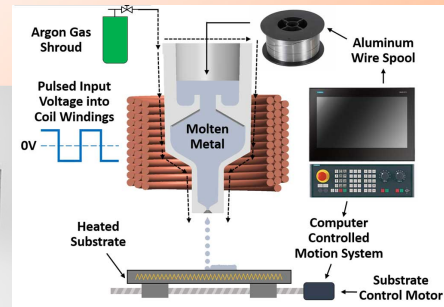
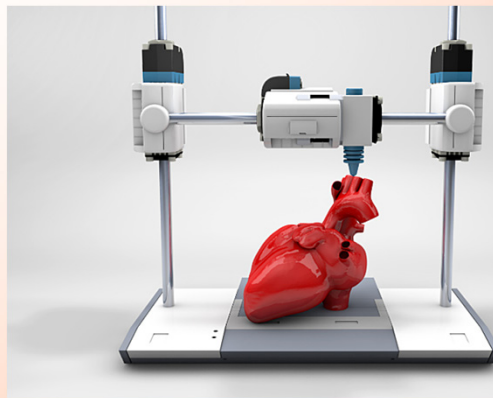
- I. Introduction
- II. Two-dimensional steady conduction
- III. **Transient conduction**
 - Lumped method
 - Spatial effects

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Transient conduction: Applications

3D Printing



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Course Overview

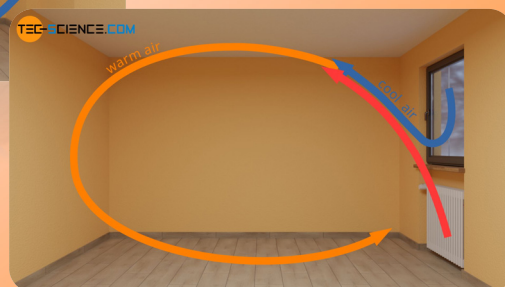
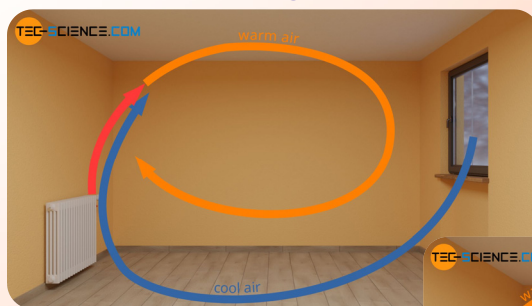
- I. Introduction
- II. Two-dimensional steady conduction
- III. Transient conduction
- IV. **Natural convection**

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Natural convection: Applications

Air conditioning



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Course Overview

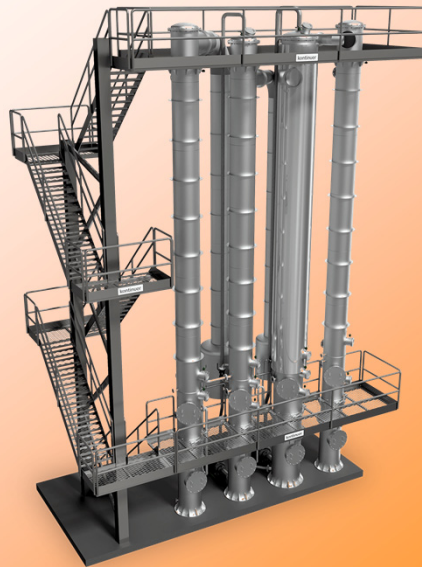
- I. Introduction
- II. Two-dimensional steady conduction
- III. Transient conduction
- IV. Natural convection
- V. **Boiling and condensation**

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Boiling and condensation: Applications

Evaporators



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Boiling and condensation: Applications

Condensers



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Course Overview

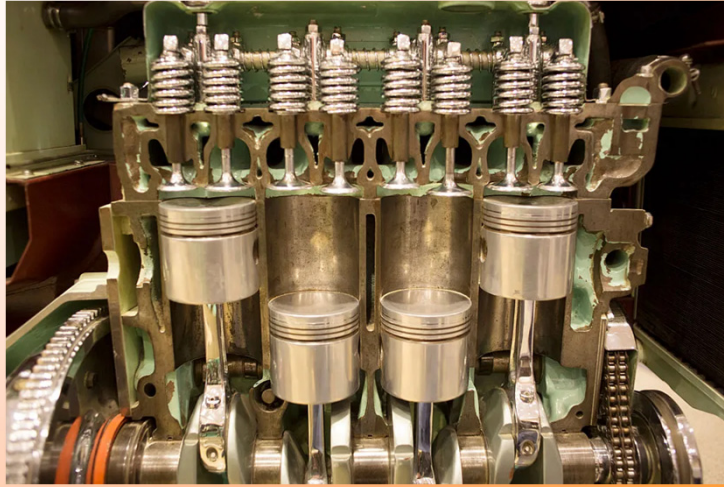
- I. Introduction
- II. Two-dimensional steady conduction
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- IV. Natural convection
- V. Boiling and condensation
- VI. **Volumetric radiation**

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Volumetric radiation: Applications

Internal combustion engines



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Volumetric radiation: Applications

Internal combustion engines



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The end of chapter 1

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