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Thermo-Mechanical Analysis for SMART Steam Generator Tube

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Abstract

In this paper, the thermal growth analysis and thermal stress analysis have been carried out for the SMART steam generator tube. The steam generator tube is subjected to high thermal loading induced by the temperature difference of the inside secondary coolant and the outside primary coolant. A single tube was modeled by pipe elements in order to investigate thermal growth of the tube in the longitudinal and the radial direction. Steam generator tube can be divided into economizer region, evaporation region, and superheated region. Tube sections for these boundaries have been modeled to analyze the thermal stress distribution. The analysis results have shown that the thermal stress gradient was most severe in the economizer region. These stress distribution acts as thermal fatigue loading since the evaporation boundary oscillates during the operation.

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[1-3].

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가 [4].

[5].

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2.

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50°C

310°C

(1)

[6].

α

$8.93 \times 10^{-6} / K$

1

$$\delta = \alpha \cdot \Delta T \cdot L$$

(1)

1.

		[mm]	[mm]
		3723	8.6
		753	0.9
		4055	9.4
		16128	37.3
		97	0.2

8.6mm

10mm

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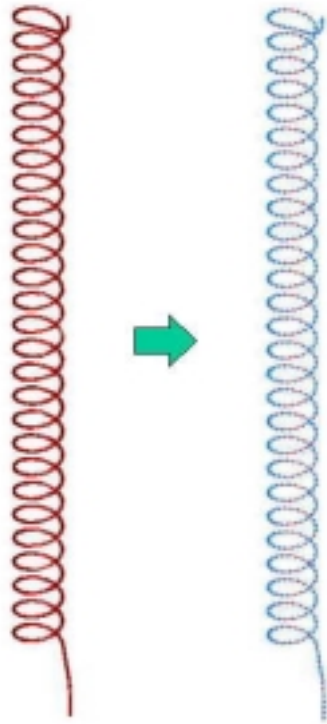
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324

17

(1)

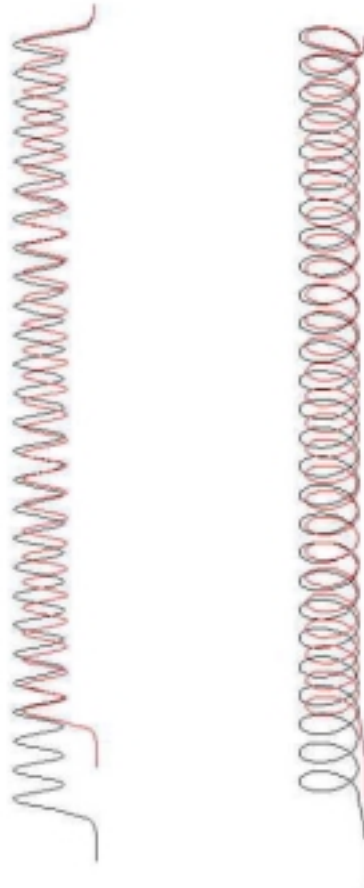
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I-DEAS Simulation Module [7].



1.

18000 W/m²C

310 °C



2.

2

2.(a)

2.(b)

2

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2.

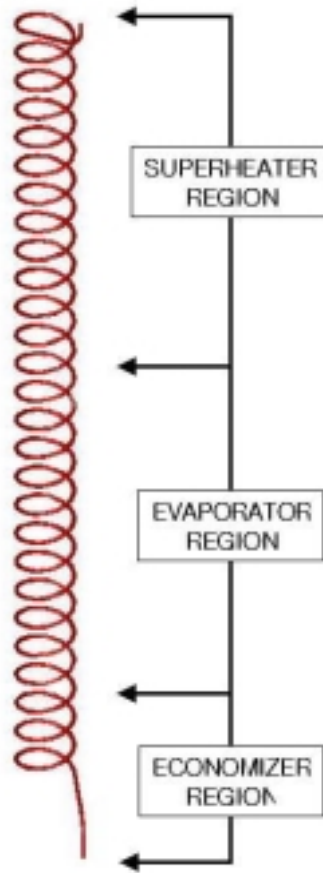
	[mm]
	8.46
	0.25

3.

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가
Evaporator region, Superheater region
, Evaporator region 가
가

. Economizer region

3 Economizer region,
가
가 , Superheater region



3.

,
Evaporator (Economizer), Evaporator (Superheater), Superheater

Economizer ,
Plane Strain

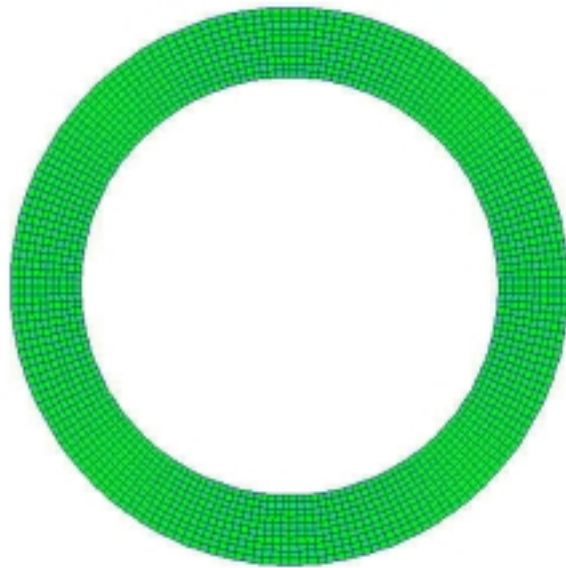
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3.

		ECONOMIZER		EVAPORATOR		SUPERHEATER	
	°C	268	274	307	310		
	MPa	15	15	15	15		
	°C	180	246	244	301		
	MPa	3.7	3.7	3.6	3.4		
-	W/m ² °C	18365	18371	18234	18334		
-	W/m ² °C	11347	30277	3049	20782		

ABAQUS/STANDARD V5.8

4 . 가 .
 4 4 DC2D4 , 4 4
 CPE4 [8].



4.

4

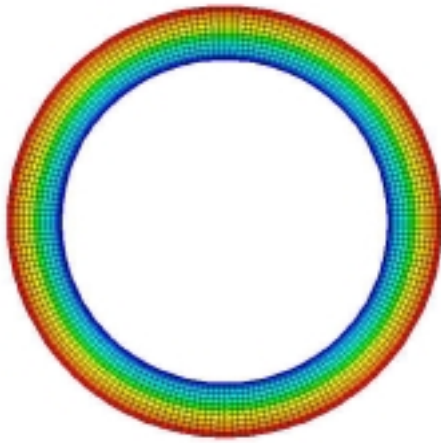
3

Economizer

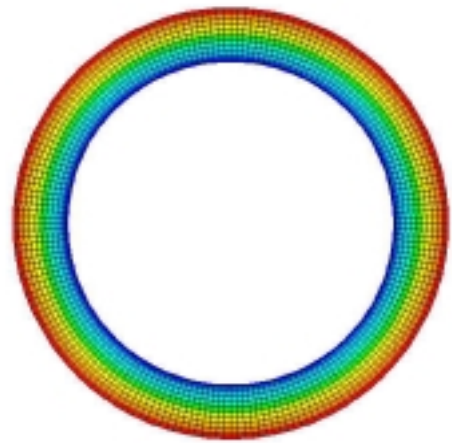
Superheater

5

6. 가 가 Economizer

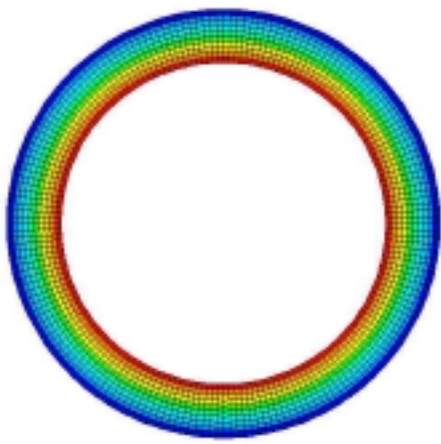


(a) Economizer

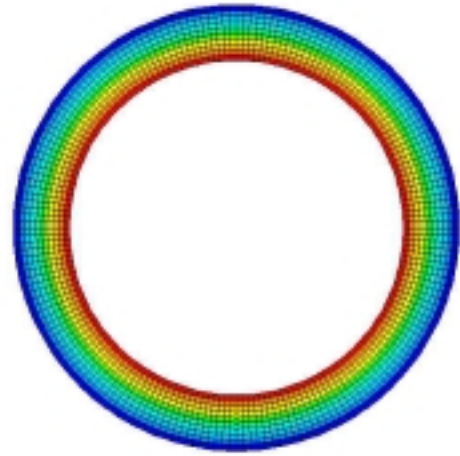
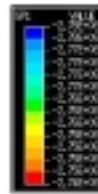


(b) Superheater

5.



(a) Economizer



(b) Economizer

6. Economizer

7

Economizer
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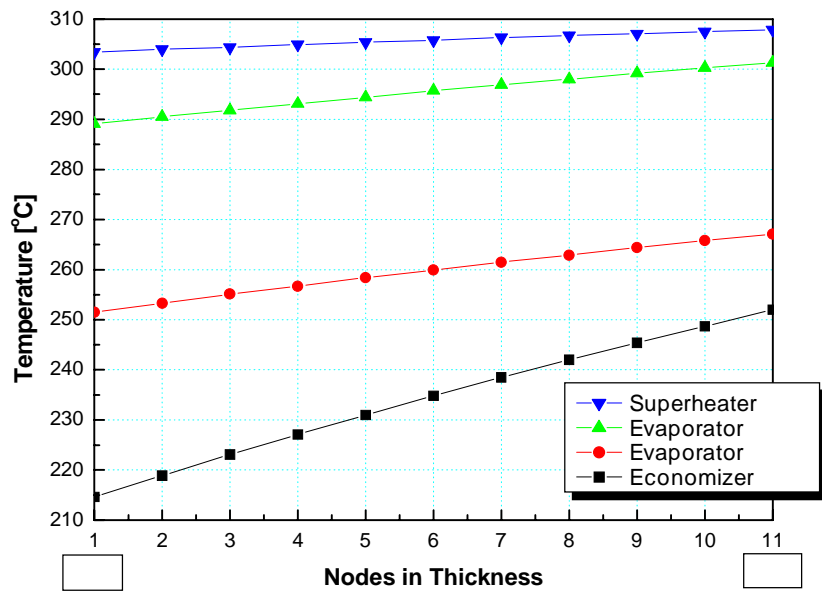
가
Superheater

. Economizer

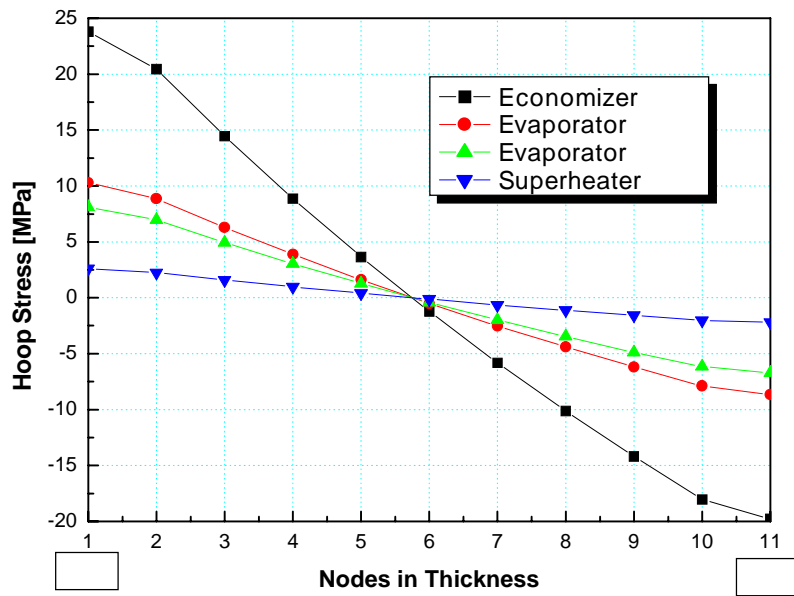
, Superheater

가 Economizer
Superheater

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7.



8.

8 . X
 S_y , Y S_x . 가 가
 8 . 가 가

Economizer 가 . Economizer Superheater
 가 .

4.

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