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1: "Proyecto de grado"
2:
3: "Definición del Ciclo Brayton"
4:
5: "Estado 1"
6: T_1=23
7: P_1=0,906592
8: h_1=Enthalpy(Air_ha;T=T_1;P=P_1)
9: s_1=Entropy(Air_ha;T=T_1;P=P_1)
10:
11: "Estado 2"
12: s_2s=s_1
13: s_2s=Entropy(Air_ha;T=T_2;P=P_2)
14: h_2s=Enthalpy(Air_ha;T=T_2;P=P_2)
15: {h_2=Enthalpy(Air_ha;T=T_2;P=P_2)}
16: r_p=P_2/P_1
17: r_p=2,185
18:
19: "Estado 3"
20: T_3=500
21: P_3=P_2
22: h_3=Enthalpy(Air_ha;T=T_3;P=P_3)
23: s_3=Entropy(Air_ha;T=T_3;P=P_3)
24:
25: "Estado 4"
26: s_4s=s_3
27: s_4s=Entropy(Air_ha;T=T_4;P=P_4)
28: h_4s=Enthalpy(Air_ha;T=T_4;P=P_4)
29: {h_2=Enthalpy(Air_ha;T=T_4;P=P_4)}
30: P_4=P_1
31:
32: "Eficiencias"
33: eta_c=0,7
34: eta_c=ws/wr
35: ws=h_2s-h_1
36: wr=h_2-h_1
37:
38: eta_t=0,8
39: eta_t=wr_t/ws_t
40: wr_t=h_3-h_4
41: ws_t=h_3-h_4s
42:
43: "Ecuación de rendimiento térmico"
44: {eta_term=w_neto/q_ent}
45: q_ent=h_3-h_2
46: w_neto=w_sal-w_ent
47: w_sal=eta_t*(w_sal_iso)
48: W_sal_iso=h_3-h_4s
49: w_ent=eta_c*(w_ent_iso)
50: w_ent_iso=h_2s-h_1
51: {w_neto=w_sal}
52: eta_term=1-(q_sal/q_ent)
53: {eta_term=0,075}
54: q_sal=h_4-h_1
55: {r_p=3,183 "Relación de presión calculada por la pendiente 0 de la gráfica"}

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Proyecto de grado

Definición del Ciclo Brayton

Estado 1

$$T_1 = 23$$

$$P_1 = 0,906592$$

$$h_1 = h \left[ \text{Air}_{\text{ha}} ; T = T_1 ; P = P_1 \right]$$

$$s_1 = s \left[ \text{Air}_{\text{ha}} ; T = T_1 ; P = P_1 \right]$$

### Estado 2

$$s_{2s} = s_1$$

$$s_{2s} = s \left[ \text{Air}_{\text{ha}} ; T = T_2 ; P = P_2 \right]$$

$$h_{2s} = h \left[ \text{Air}_{\text{ha}} ; T = T_2 ; P = P_2 \right]$$

$$r_p = \frac{P_2}{P_1}$$

$$r_p = 2,185$$

### Estado 3

$$T_3 = 500$$

$$P_3 = P_2$$

$$h_3 = h \left[ \text{Air}_{\text{ha}} ; T = T_3 ; P = P_3 \right]$$

$$s_3 = s \left[ \text{Air}_{\text{ha}} ; T = T_3 ; P = P_3 \right]$$

### Estado 4

$$s_{4s} = s_3$$

$$s_{4s} = s \left[ \text{Air}_{\text{ha}} ; T = T_4 ; P = P_4 \right]$$

$$h_{4s} = h \left[ \text{Air}_{\text{ha}} ; T = T_4 ; P = P_4 \right]$$

$$P_4 = P_1$$

### Eficiencias

$$\eta_c = 0,7$$

$$\eta_c = \frac{ws}{wr}$$

$$ws = h_{2s} - h_1$$

$$wr = h_2 - h_1$$

$$\eta_t = 0,8$$

$$\eta_t = \frac{wr_t}{ws_t}$$

$$wr_t = h_3 - h_4$$

$$ws_t = h_3 - h_{4s}$$

Ecuación de rendimiento térmico

$$q_{\text{ent}} = h_3 - h_2$$

$$W_{\text{neto}} = W_{\text{sal}} - W_{\text{ent}}$$

$$W_{\text{sal}} = \eta_t \cdot W_{\text{sal;iso}}$$

$$W_{\text{sal;iso}} = h_3 - h_{4s}$$

$$W_{\text{ent}} = \eta_c \cdot W_{\text{ent;iso}}$$

$$W_{\text{ent;iso}} = h_{2s} - h_1$$

$$\eta_{\text{term}} = 1 - \frac{q_{\text{sal}}}{q_{\text{ent}}}$$

$$q_{\text{sal}} = h_4 - h_1$$

SOLUTION

Unit Settings: SI C bar kJ mass deg

$$\eta_c = 0,7$$

$$h_1 = 296,5$$

$$h_3 = 793,1$$

$$P_1 = 0,9066$$

$$P_4 = 0,9066$$

$$r_p = 2,1850$$

$$s_3 = 7,654$$

$$T_2 = 96,99$$

$$w_r = 106,4$$

$$w_{st} = 156,8$$

$$W_{\text{neto}} = 73,28$$

$$\eta_t = 0,8$$

$$h_2 = 402,8$$

$$h_4 = 667,7$$

$$P_2 = 1,981$$

$$q_{\text{ent}} = 390,3$$

$$s_1 = 6,886$$

$$s_{4s} = 7,654$$

$$T_3 = 500$$

$$w_{rt} = 125,4$$

$$W_{\text{ent}} = 52,12$$

$$W_{\text{sal}} = 125,4$$

$$\eta_{\text{term}} = 0,0487706$$

$$h_{2s} = 370,9$$

$$h_{4s} = 636,4$$

$$P_3 = 1,981$$

$$q_{\text{sal}} = 371,3$$

$$s_{2s} = 6,886$$

$$T_1 = 23$$

$$T_4 = 354,2$$

$$w_s = 74,46$$

$$W_{\text{ent;iso}} = 74,46$$

$$W_{\text{sal;iso}} = 156,8$$

8 potential unit problems were detected.

There are a total of 33 equations in the Main program.

Block	Rel. Res.	Abs. Res.	Units	Calls	Time(ms)	Equations
0	0.000E+00	0.000E+00	OK	1	0	T_1=23
0	0.000E+00	0.000E+00	OK	1	0	P_1=0,906592
0	0.000E+00	0.000E+00	OK	1	0	r_p=2,185
0	0.000E+00	0.000E+00	OK	1	0	T_3=500
0	0.000E+00	0.000E+00	OK	1	0	eta_c=0,7
0	0.000E+00	0.000E+00	OK	1	0	eta_t=0,8
0	0.000E+00	0.000E+00	?	4	0	h_1=Enthalpy(Air_ha;T=T_1;P=P_1)
0	0.000E+00	0.000E+00	?	4	0	s_1=Entropy(Air_ha;T=T_1;P=P_1)
0	0.000E+00	0.000E+00	OK	4	0	s_2s=s_1
0	0.000E+00	0.000E+00	OK	4	0	P_4=P_1
0	0.000E+00	0.000E+00	OK	4	0	r_p=P_2/P_1
0	0.000E+00	0.000E+00	OK	4	0	P_3=P_2
0	0.000E+00	0.000E+00	?	4	0	h_3=Enthalpy(Air_ha;T=T_3;P=P_3)
0	0.000E+00	0.000E+00	?	4	0	s_3=Entropy(Air_ha;T=T_3;P=P_3)
0	0.000E+00	0.000E+00	OK	4	0	s_4s=s_3
0	1,672E-08	-1,279E-07	?	5	0	s_4s=Entropy(Air_ha;T=T_4;P=P_4)
0	0.000E+00	0.000E+00	?	4	0	h_4s=Enthalpy(Air_ha;T=T_4;P=P_4)
0	0.000E+00	0.000E+00	OK	4	0	w_s_t=h_3-h_4s
0	0.000E+00	0.000E+00	OK	4	0	w_sal_iso=h_3-h_4s
0	2,586E-09	-1,781E-08	?	5	0	s_2s=Entropy(Air_ha;T=T_2;P=P_2)

0	0.000E+00	0.000E+00	?	4	0	<b>h_2s</b> =Enthalpy(Air_ha;T=T_2;P=P_2)
0	0.000E+00	0.000E+00	OK	4	0	<b>ws</b> =h_2s-h_1
0	0.000E+00	0.000E+00	OK	4	0	<b>eta_t</b> = <b>wr_t</b> / <b>ws_t</b>
0	0.000E+00	0.000E+00	OK	4	0	<b>wr_t</b> =h_3-h_4
0	0.000E+00	0.000E+00	OK	4	0	<b>w_sal</b> =eta_t*(w_sal_iso)
0	0.000E+00	0.000E+00	OK	4	0	<b>w_ent_iso</b> =h_2s-h_1
0	0.000E+00	0.000E+00	OK	4	0	<b>q_sal</b> =h_4-h_1
0	0.000E+00	0.000E+00	OK	4	0	<b>eta_c</b> =ws/wr
0	6,524E-20	6,939E-18	OK	4	0	<b>wr</b> =h_2-h_1
0	0.000E+00	0.000E+00	OK	4	0	<b>q_ent</b> =h_3-h_2
0	0.000E+00	0.000E+00	OK	4	0	<b>w_ent</b> =eta_c*(w_ent_iso)
0	0.000E+00	0.000E+00	OK	4	0	<b>eta_term</b> =1-(q_sal/q_ent)
0	0.000E+00	0.000E+00	OK	4	0	<b>w_net</b> =w_sal-w_ent

**Parametric Table: Trabajo**

	<b>r<sub>p</sub></b>	<b>w<sub>net</sub></b>
Run 1	1,0000	0,0007114
Run 2	1,1837	19,02
Run 3	1,3673	33,87
Run 4	1,5510	45,79
Run 5	1,7347	55,56
Run 6	1,9184	63,68
Run 7	2,1020	70,53
Run 8	2,2857	76,37
Run 9	2,4694	81,37
Run 10	2,6531	85,7
Run 11	2,8367	89,46
Run 12	3,0204	92,74
Run 13	3,2041	95,62
Run 14	3,3878	98,14
Run 15	3,5714	100,4
Run 16	3,7551	102,3
Run 17	3,9388	104,1
Run 18	4,1224	105,6
Run 19	4,3061	106,9
Run 20	4,4898	108,1
Run 21	4,6735	109,1
Run 22	4,8571	110,1
Run 23	5,0408	110,8
Run 24	5,2245	111,5
Run 25	5,4082	112,1
Run 26	5,5918	112,6
Run 27	5,7755	113,1
Run 28	5,9592	113,4
Run 29	6,1429	113,7
Run 30	6,3265	114
Run 31	6,5102	114,1
Run 32	6,6939	114,3
Run 33	6,8776	114,3
Run 34	7,0612	114,4
Run 35	7,2449	114,4
Run 36	7,4286	114,3
Run 37	7,6122	114,3
Run 38	7,7959	114,2
Run 39	7,9796	114
Run 40	8,1633	113,9
Run 41	8,3469	113,7

**Parametric Table: Trabajo**

	$r_p$	$w_{neto}$
Run 42	8,5306	113,5
Run 43	8,7143	113,2
Run 44	8,8980	113
Run 45	9,0816	112,7
Run 46	9,2653	112,4
Run 47	9,4490	112,1
Run 48	9,6327	111,8
Run 49	9,8163	111,4
Run 50	10,0000	111,1





