



قال تعالى

سُودْنَا بِبِلَابِيَّاتٍ وَأَنْزَلْنَا مَعَهُمُ
الْكِتَابَ وَالْأَمِيرَ الَّذِي قَوْمَ النَّاسِ بِالْقِسْطِ وَأَنْزَلْنَا
فِيهِ الْبَحْثَ الشَّدِيدَ وَمَنَافِعُ لِلنَّاسِ وَلِيَعْلَمَ
اللَّهُ مَنْ يَنْصُرُهُ وَرُسُلَهُ بِالْغَيْبِ إِنَّ اللَّهَ قَوِيٌّ
عَزِيزٌ .

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Abstract

A finite-time thermodynamic modelling and simulation of irreversible Joule-Brayton cycle has been developed taking into account the variability of specific heats for working fluid due to temperature variation.

The effect of parameters on the engine was discussed, which is the internal irreversibility.

A program was developed by using MATLAB software to perform the necessary calculations of thermodynamic model.

According to the results obtained, it was found that the results obtained from the thermodynamic model compared with the results obtained from experiments are convergent, and may be used in actual engine designs and applications.

تجريد

تم تطوير نموذج محاكاة لمحرك يعمل وفقاً لدورة جول - برايتون اللاعكوسية وذلك باستخدام طريقة الحركات الحرارية محدودة الزمن مع الأخذ بعين الاعتبار التغير في قيم السعات الحرارية بالنسبة للمادة العاملة تبعاً للتغير في قيم درجات الحرارة. تمت مناقشة عوامل اللاعكوسية الداخلية التي تؤثر على المحرك.

تم استخدام برنامج ماثلاب لإجراء الحسابات اللازمة للنموذج. وفقاً للنتائج التي تم الحصول عليها تبين أن النتائج التي تم الحصول عليها من هذا النموذج مقارنة مع النتائج التي يتم الحصول عليها من التجارب العملية متقاربة وبالتالي يمكن استخدام هذه النتائج مستقبلاً في تصميم المحرك وتطبيقاته المختلفة.

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Abbreviations & Symbols

A/Abbreviations:

C.V	Calorific value
L.M.T.	Logarithmic mean temperature
S.F.C.	Specific fuel consumption

B/ List of symbols:

Symbol	Function	Unit
$\frac{A}{F}$	Air-fuel ratio	
C_p	The constant pressure specific heat	kJ/kg.K
C_{p_a}	The constant pressure specific heat for air	kJ/kg.K
$C_{p_{mix}}$	The constant pressure specific heat for mixture	kJ/kg.K
C_v	The constant volume specific heat	kJ/kg.K
D	The diffusion coefficient	m ² /s
η_I	First law efficiency	%
η_{II}	Second law efficiency	%
η_c	Isentropic efficiency for compressor	%
η_T	Isentropic efficiency for turbine	%
η_{th}	Thermal efficiency	%
η_{Carnot}	Carnot cycle efficiency	%
η_{Nov}	Novicov efficiency	%
I	The flux of electric current	N.m ² /C
J	The diffusion flux	kmol/m ² .s
K_H	Finite heat conductance for source reservoir	kW/m.K
K_L	Finite heat conductance for sink reservoir	kW/m.K
λ	The thermal conductivity	kW/m.K
M_i	The molecular weight for component i	kg/kmol
$\dot{m}_a$	The mass flow rate of air	kg/s
$\dot{m}_f$	The mass flow rate of fuel	kg/s
n_a	Number of moles for air	kmol
$\dot{W}_{net}$	The net output power	kW
$\dot{Q}_{add}$	The added heat flow-rate	kW
R	The gas constant	kJ/kg.K

R_u	The universal gas constant	kJ/kg.K
r_p	The pressure ratio	
$S.F.C.$	Specific fuel consumption	kg/kW.hr
T_1	Temperature of inlet air	K
T_{iH}	Internal high temperature for source reservoir	K
T_{iL}	Internal low temperature for sink reservoir	K
T_H	Temperature of source thermal reservoir	K
T_L	Temperature of sink thermal reservoir	K
x_i	The mass fraction for component <i>i</i> .	
y_i	The mole fraction for component <i>i</i> .	

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