Dedication

To my colleagues, students and researchers.

Acknowledgement

First of all, giving thanks to Allah,

And a special thanks to supervisor

DR. ALI MOHAMMED HAMDAN ADAM.

I can’t forget giving thanks to everyone who helped me and gave me a new hope for successful.

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Abstract

A finite-time thermodynamic modeling and simulation of irreversible Diesel cycle engines has been developed taking into account the variabilityof specific heats for working fluid due to temperature variation.

The effect of four different parameters on the engine was discussed, which are: the internal irreversibility, the heat losses, the friction losses and the cut-off ratio.

A program was developed by using MATLAB software to perform the necessary calculations ofthermodynamic 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.

تم تطوير نموذج محاكاة لمحرك يعمل وفقاً لدورة ديزل اللاعكوسية وذلك باستخدام طريقة الحركيات الحرارية محدودة الزمن مع الأخذ بعين الاعتبار التغير في قيم السعات الحرارية بالنسبة للمادة العاملة تبعاً للتغير في قيم درجات الحرارة.

أربع عوامل مختلفة تؤثر على المحرك تمت مناقشتها، وهي: اللاعكوسية الداخلية، فقد الحرارة، فقد الإحتكاك ونسبة القطع.

تم استخدام برنامج ماتلاب 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 المعملية متقاربةوبالتالي يمكن استخدام هذه النتائج مستقبلاً في تصميم المحرك وتطبيقاته المختلفة.

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Symbol	Function	Unit
B	Heat leakage coefficient of the cylinder wall	kJ/kg.K
C_p	The constant pressure specific heat	kJ/kg.K
C_v	The constant volume specific heat	kJ/kg.K
D	The diffusion coefficient	m^2/s
F_μ	The friction force	N
η_I	First law efficiency	%
η_{II}	Second law efficiency	%
η_c	Compression efficiency	%
η_e	Expansion efficiency	%
η_{th}	Thermal efficiency	%
$\eta_{th,rev}$	The maximum possible thermal 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
L	Stroke length of the cylinder	m
λ	The thermal conductivity	kW/m.K
M_i	The molecular weight for component ***i***	kg/kmol
$\dot{m}$	The mass flow rate of working substance	kg/s
μ	Friction coefficient for global losses	N.s/m
N	The rotational speed of the engine	rev/sec
P_μ	The friction power	kW
P_{net}	The net output power	kW
q	The heat flux	kW/m^2
$\dot{Q}_{add}$	The added heat flow-rate	kW
$\dot{Q}_{loss}$	The flow-rate of heat loss	kW

$\dot{Q}_{rej}$	The rejected heat flow-rate	kW
R	The gas constant	kJ/kg.K
R_u	The universal gas constant	kJ/kg.K
r_c	The cut-off ratio	
r_e	The expansion ratio	
r_v	The compression ratio	
σ_e	The electric conductivity	kg
T_1	Temperature of source thermal reservoir	K
T_2	Temperature of sink thermal reservoir	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
T_0	The average temperature of the working fluid and cylinder walls	K
v	Mean piston speed	m/s
x	Piston displacement	m
x_i	The mass fraction for component ***i***.	

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