

STUDY OF EFFECTS OF FUEL INJECTION PRESSURE
ON PERFORMANCE FOR DIESEL ENGINE

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Thesis submitted in fulfilment of the requirements for the award of the
Bachelor of Mechanical Engineering with Automotive Engineering

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this project and in my opinion, this project is adequate in terms of scope and quality for the award of the Bachelor of Mechanical Engineering with Automotive Engineering.

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STUDENT'S DECLARATION

I hereby declare that the work in this project is my own except for quotations and summaries which have been duly acknowledged. The project has not been accepted for any degree and is not concurrently submitted for award of other degree.

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LIST OF SYMBOLS

SYMBOL	DESCRIPTION
A	pipe inside cross section area, cross-section area of a moving part, controlling area
A_g	geometric cross-section area of a flow passage
$a_{c0} \dots a_{c2}$	polynomial coefficients of speed of pressure pulse
$a_{p0} \dots a_{p2}$	polynomial coefficients of diesel oil density
c	speed of pressure pulse in diesel oil, speed of pressure pulse in fluid,
d	pipe inside diameter, piston diameter
f	friction factor, viscous damping coefficient
F_0	spring initial force
g	acceleration due to gravity
K	bulk modulus of elasticity of fluid, modulus of elasticity
k	spring rate
l	gap length
M	molar mass of vapour
m	moving mass of valve
n_{in}	number of volumetric flows entering the container
n_m	number of moving parts
n_{out}	number of volumetric flow exiting the container
n_v	number of controlling pressures
P, p	pressure
\dot{p}	total derivative of pressure in relation to time
p_0	initial pressure
p_1	pressure before the flow passage
p_2	pressure after the flow passage
ρ	density, fluid density, density of homogenous fluid
ρ_v	vapour density, density of fluid vapour
ρ_0	density of diesel oil at initial pressure
q_v	volume flow rate

q_{vin}	volume flow rate into a node, volumetric flow entering the container
q_{vout}	volume flow rate out of a node, volumetric flow exiting the container
R	molar gas constant
Re	Reynolds number
T	temperature
t	time
v	fluid velocity, velocity of the moving part, valve velocity
V	volume
V_{cav}	cavitation volume
v_1	velocity at the inlet point of the flow passage
x	distance along pipe axis, lift of a moving part, valve lift

LIST OF GREEK SYMBOLS

SYMBOL	DESCRIPTION
α	pipe angle to horizontal plane
δ	clearance between piston and sleeve
δ/d	relative roughness of the inside surface of the pipe
Δp	pressure difference between the sleeve ends
Δt	time step
μ	flow coefficient
μ'	fictive flow coefficient
η	dynamic viscosity of the fluid

LIST OF SUBSCRIPTS

SUBSCRIPT	DESCRIPTION
$c_0...c_2$	polynomial coefficients of speed of pressure pulse
cav	cavitation volume
g	geometric cross-section area of a flow passage
in	volumetric flows entering the container
m	moving parts
out	volumetric flow exiting the container
$\rho_0... \rho_2$	polynomial coefficients of diesel oil density
v	controlling pressures, vapour, fluid vapour, volume
vin	volume flow rate into a node, volumetric flow entering the container
$vout$	volume flow rate out of a node, volumetric flow exiting the container

LIST OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
NO	Nitrogen Monoxide
NO_x	Nitrogen Oxides
HC	Hydrocarbon
CO	Carbon Monoxide
SO	Sulphur Monoxide
HSDI	High Speed Direct Injection
ECU	Electronic Control Unit
EFI	Electronic Fuel Injection
TBI	Throttle Body Injection