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(<sup>1</sup>)GRI3

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## **Quasi-Dimensional Combustion Model for Predicting Combustion and Emission of Dual Fuel Diesel Engines**

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### **Abstract**

The present work includes a quasi-dimensional combustion model to predict the combustion of direct injection dual fuel diesel engines by a detailed chemical kinetic model for gaseous fuel combustion. Chemical kinetic model consist of 325 reactions with 53 species (GRI3). Heat release rate of pilot fuel at this model is considered by two Wiebe functions. Predicted values of cylinder pressure for dual fuel operation show good agreement with corresponding previous experimental data.

**Key words:** Dual fuel, Diesel engines, Combustion modeling, Emission, Chemical kinetics, Pilot fuel.

NO<sub>x</sub>

CFD

[ ]

[ ]

Karim

NO<sub>x</sub>

UHC CO

[ ]

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Takashi

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EGR

NO<sub>x</sub>

EGR

EGR

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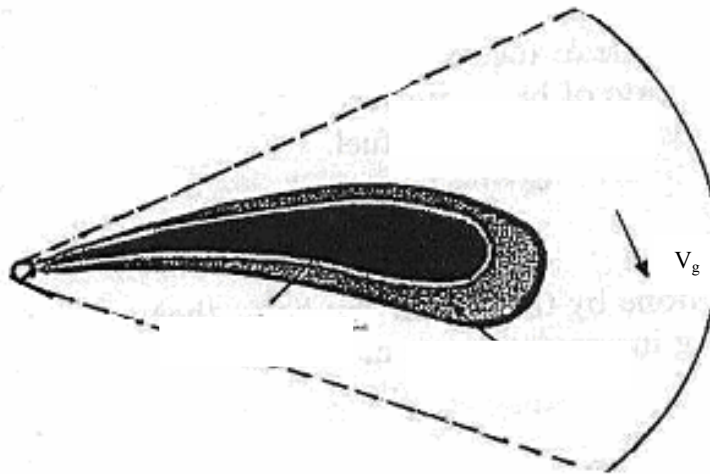
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Methane	Ethane	Propane	i-Butane	n-Butane
/	/	/	/	/
neo-pentane	i- pentane	n- pentane	Hexanes	Carbon Dioxide
/	/	/	/	/
Nitrogen	Heptanes	Octane		
/	/	/		



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$$k_{jf} = A_{jf} T^\beta \exp\left(\frac{-E_{jf}}{TR}\right) \quad j = \dots, \quad (1)$$

$$k_{jb} = \frac{k_{jf}}{k_{jc}} \quad j = \dots, \quad (2)$$

$$R_{jf} = k_{jf} \prod_{i=1}^{53} (\rho x_i)^{\alpha_{ijf}} \quad j = \dots, \quad (3)$$

$$R_{jb} = k_{jb} \prod_{i=1}^{53} (\rho x_i)^{\alpha_{ijb}} \quad j = \dots, \quad (4)$$

$$V = f(t) = \frac{M}{\rho} \quad (5)$$

$$-\rho \frac{dx_i}{dt} = \sum_{j=1}^{325} (\alpha_{ijf} - \alpha_{ijb})(R_{jf} - R_{jb}) \quad i = \dots, \quad (6)$$

$$PV = MRT \quad (7)$$

$$\frac{dQ}{d\theta} = a \left(\frac{Q_p}{\theta_p}\right)^{m_p} \left(\frac{\theta - \theta_s}{\theta_p}\right)^{m_p - 1} \exp\left(-a \left(\frac{\theta - \theta_s}{\theta_p}\right)^{m_p}\right) + a \left(\frac{Q_d}{\theta_d}\right)^{m_d} \left(\frac{\theta - \theta_s}{\theta_d}\right)^{m_d - 1} \exp\left(-a \left(\frac{\theta - \theta_s}{\theta_d}\right)^{m_d}\right) \quad (8)$$

"d" "p"  
 "θ<sub>d</sub>" "θ<sub>p</sub>"  
 "Q<sub>d</sub>" "Q<sub>p</sub>"

H2, H, O, O2, OH, H2O, HO2, H2O2, C, CH, CH2, CH2(S), CH3, CH4, CO, CO2, HCO, CH2O, CH2OH, CH3O, CH3OH, C2H, C2H2, C2H3, 2H4, C2H5, C2H6, HCCO, CH2CO, HCCOH, N, NH, NH2, NH3, NNH, NO, NO2, N2O, HNO, CN, HCN, H2CN, HCNN, HCNO, HOCN, HNCO, NCO, N2, AR, C3H7, C3H8, CH2CHO, CH3CHO.

$$\sum_{i=1}^{53} \alpha_{ijf} A_i \Leftrightarrow \sum_{i=1}^{53} \alpha_{ijb} A_i \quad j = \dots, \quad (9)$$

( ) R T P M

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$$\sum_{i=1}^{53} x_i \bar{R} T \times \frac{f'(t)}{f(t)} + \sum_{i=1}^{53} \left\{ \int_{T_0}^T C_{Vi} dT + \Delta U_{fi} \right\} \frac{dx_i}{dt} + x_i C_{Vi} \frac{dT}{dt} = \dot{Q}_p \quad ( )$$

$\dot{Q}_p$

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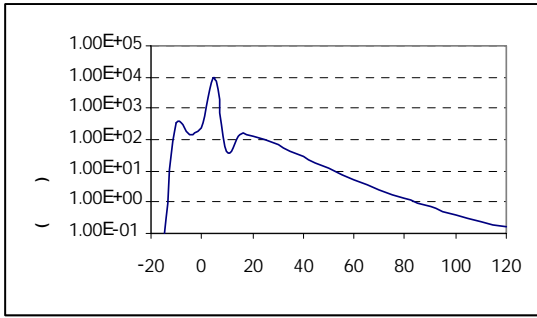
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rpm / kg/h

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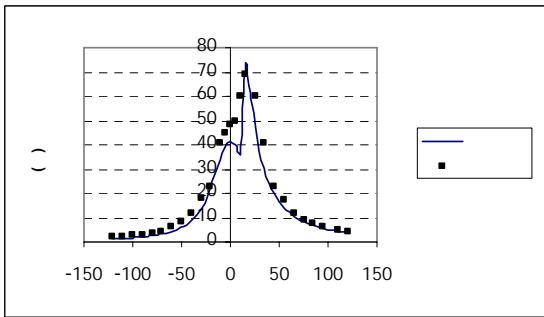
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OM355 -	
rpm	
N.m	
rpm	
	:
*	*
/ ( liter)	
:	

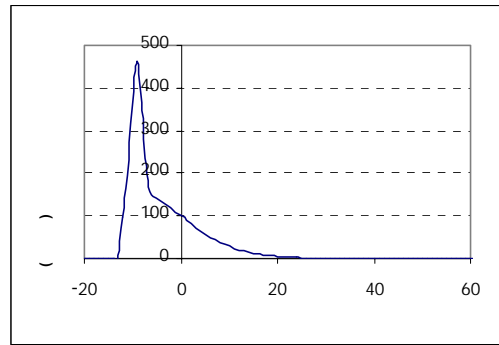


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1400 rpm



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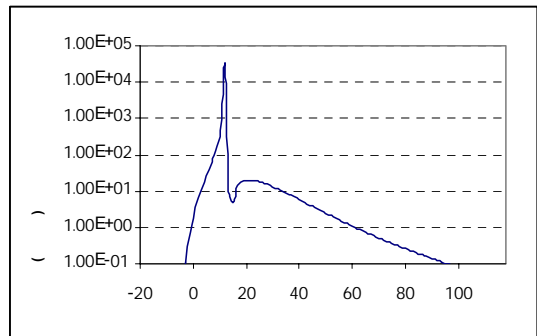
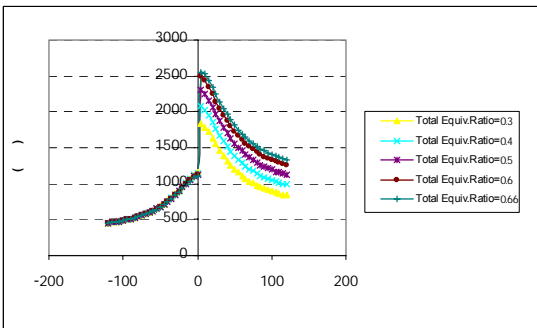


1400 rpm

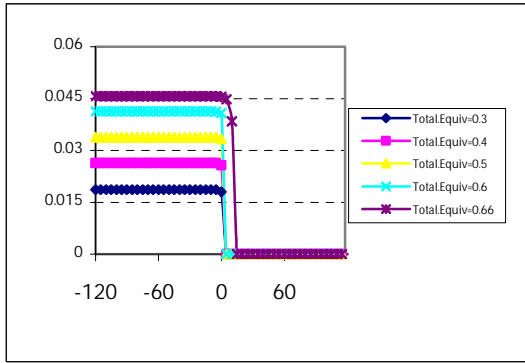
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rpm / kg/h

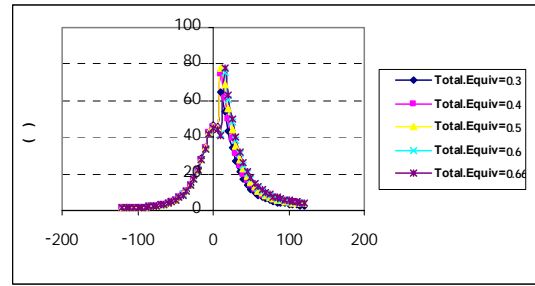
1400 rpm



1400 rpm



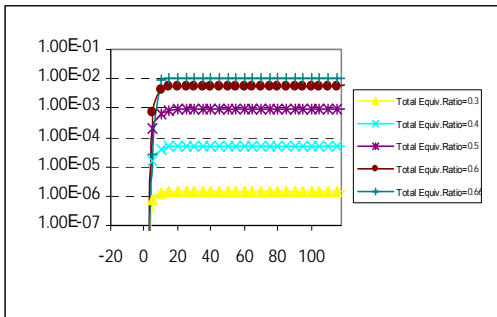
UHC



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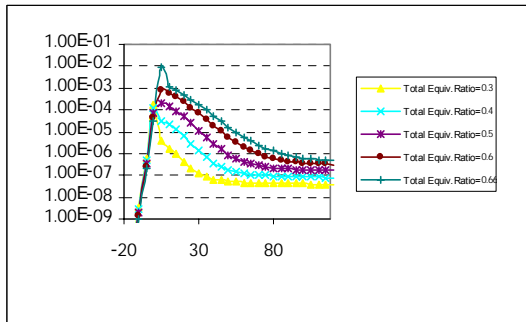
NO CO UHC

( )



NO

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CO

NO

( )

( )

NO

CO

UHC

/

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CO

CO

CO

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rpm

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CO

		NO(ppm)
/	/	CO(%vol)
-	-	PM
		UHC(ppm)

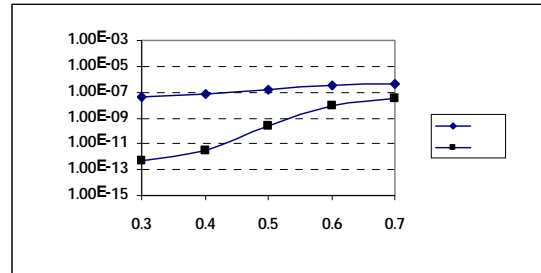
CO

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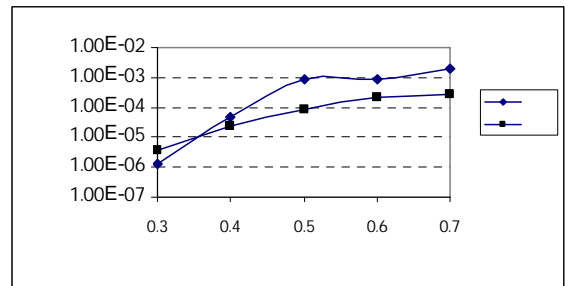
NO CO

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CO

CO UHC



NO



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- $\theta$
- $m$
- $Q$
- $a$
- $x$
- $A$
- $\alpha$
- $k$
- $R$
- $\rho$
- $M$
- $p$
- $T$
- $C_V$
- $\Delta U$
- .i
- j
- f
- b
- d
- p
- s
- c
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