Engine Design

Chapter 04: Engine Dynamics

by
Mohd Razali Hanipah
Faculty of Mechanical Engineering
mohdrazali@ump.edu.my

Engine Dynamics

- This chapter focus on the force interactions during IC engine operations.

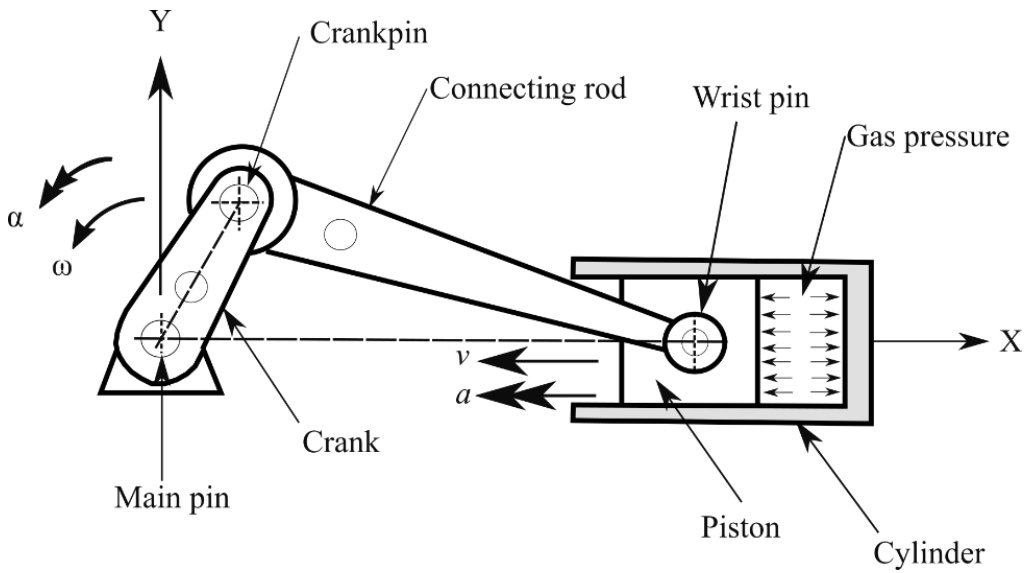


Figure 4-1 Linear and angular accelerations due to combustion

Gas Force

- The gas force resulting from the combustion gas pressure from the exploding air-fuel mixture on top of the piston.
- . Let F_g = gas force, P_g = gas pressure, A_P = area of piston and B = bore of cylinder which is equal to the diameter of piston. Then;

Gas Force (N)

$$F_g = \frac{\pi}{4} . P_g . B^2$$

Gas Torque

- The resulting gas force is rotating the crank-slider mechanism about the crankshaft, at a distance *x,* producing gas torque:
- **Piston Position (m)**

$$x = r.(sin\,\theta + \left(1 + \frac{r}{l}\,cos\,\theta\right))$$

- **Approximate Gas Torque (Nm)** Tg_a
- $Tg_a = \ Piston\ Postion\ (m)\ .Gas\ Force\ (N)$

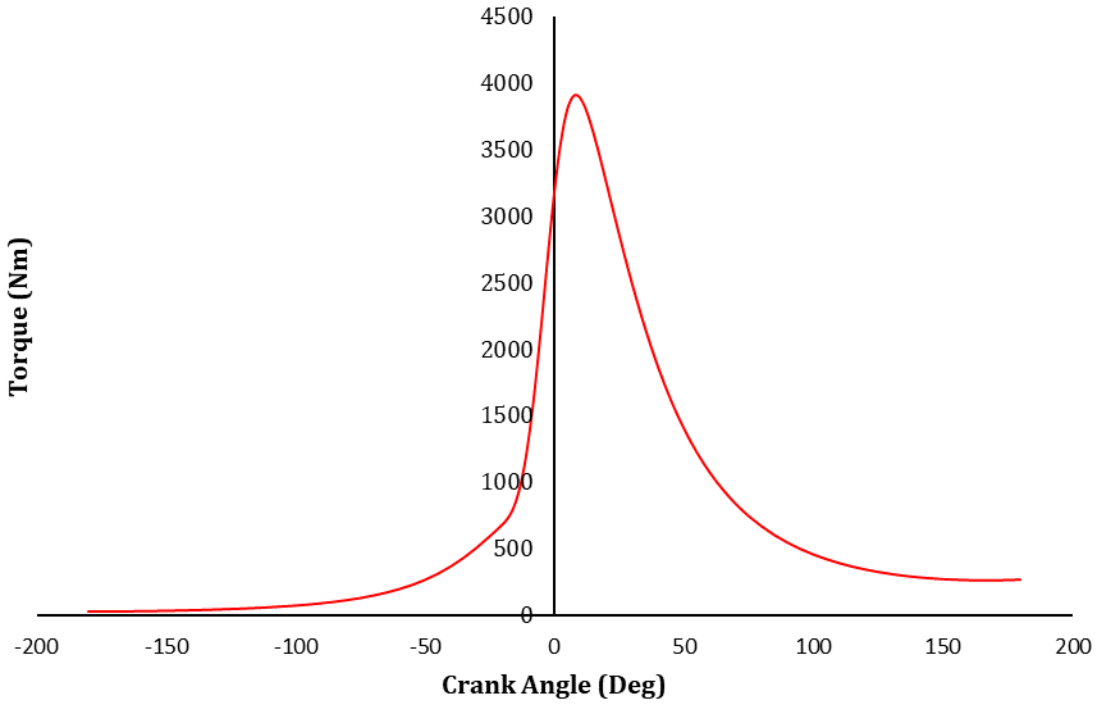
- **Exact Gas Torque (Nm)** Tg_e

$$\emptyset = atan\left(\frac{r\ sin\ \theta}{l.\sqrt{1-\left(\frac{r}{l}\ sin\ \theta\right)^2}}\right)$$

$$\hat{x} = r.cos\ \theta + l.\sqrt{1-\left(\frac{r}{l}\ sin\ \theta\right)^2}$$

$$Tg_e = F_g\ .tan\ (\emptyset).\hat{x}$$

Approximate Gas Torque vs. Crank Angle



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Other relevant information (if any)

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