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# ENGINE VALVE ADAPTIVE VIBRATION USING FUEL FLOW SENSOR DATA TRANSDUCTION FEEDBACK CONTROL

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**Abstract**
This research used self-ignition temperature of an engine valve to optimize energy transduction. Signals are activated each time the cam lobe opens to discharge burnt gases. Those signals are sent to the human machine interface (HMI) to adjust idle stroke of the engine timing and lagging stage. Each amplitude was evaluated at fixed and varied sampling frequency with modulated wave signal generated. It was found that engine valve performance sample at 1.5 seconds yields normal amplitude of 0.06m/s. This will reduce excessive sealing of the valve face angle, spring retainer and fuel leakage at the engine edge block openings.

**Keywords:** Engine, Valve, Vibration, Fuel, Transduction.

## Introduction

Fuel is a combustible gas used to power an internal combustion engine (ICE) regulated by opening and closing of automobile valves (Siczek, 2009). Sometime gravimetric fuel value decreases due to weak excitation of energies due to incomplete combustion of air- fuel intake (Abdullah et al., 2014). The intake valve allows fuel to come inside the cylinder at high temperature and pressure due to compressed heat reaction in contact with spark plug (Zhang et al., 2023). This research is narrowed on how to utilize real time system, computer vision and image processing within a set point to dispense fuel (Roodnik, 2016). Model for experimenting flame test (Kim et al., 2023) to evaluate piston dynamic behaviour, momentum through quasi-static and transient numerical codes has an impact on the cylinder wall. The control metric was not efficient in stabilizing tolerance on a single-cylinder petrol engine (Karabacak et al., 2024).

This tends to reduce contact lag, computational diagnosis and delay in delivery to intricate part of the engine (Chen, 2023). This sound is forwarded using protrude valve to visualize the acoustic behavioir the engine enclosed system (Elaraby et al., 2025). Traditional method uses inference test to (Zonta et al., 2020) determine when the combustion reaction is faulty. Traditional method is time consuming and can lead to poor fitting of the seals and less stroke produced by radial interference (Zhao, et al.,2019). Vibration is an essential metric to be resolved which causes misalignment (Saleh & Chaichan., 2015) and drive valve instability.

## Material And Method

The material used for this research was reinforced ash charcoal nano with scale 1.03 nm and blended Naseem oil 0.01 viscosity index. The head seal was covered and fractioned with resistant spray with gel adjustable meshed filter to reduce carbon monoxide stain. At each firing cycle of the rod, it was found the speed is optimal when surface roughness was low. Sensing instrument used to conduct this research consist of flow sensor, 3-axis accelerometer sensor, sensor displacement sensor, smoke sensor alongside microcontroller to generate signal acquisition to track overheating. The engine speed in revolution per minutes were varied at higher threshold using Python program. At 5 kilohertz sampling echoes from the engine were made visible at 30 seconds when force is produced by the pneumatic actuator as torques decreases. Fluctuation of torque when the length of the rod wears away affects self

-ignition control temperature (Zhou et al., 2017). This analysis was repeated by taking mean average of recurrence outcome due to negative feedback loop in 5 order calibration of pneumatic drive of the valve.

## Result And Discussion

The stress wave transforms with spring elasticity was tested through imaging to track deformation. The valve face increases as the heat flux increases with decrease in tensile strength. Comparison was done as the volume of fuel within the ranges of scaling tolerance strokes travel slowly. Model were designed to enhance valve shell life and thermodynamic phase as valve stem deforms. Sampling frequency of 5kilohertz at 20 revolution per minutes with 6 crank engine valve was evaluated with density of 6.3 kg/$m^3$ to produce reading in table 1.0 below.

**Table: 1.0. Sampling of Frequency for Density Scaling Responses**

| Time (sec) | Sampling Frequency(Hz) | Amplitude Normal valve (m/s) | Amplitude Faulty valve (m/s) | Density Of Sound |
|---|---|---|---|---|
| **0.50** | 1000 | 0.20 | 0.01 | 1.60 |
| **2.07** | 750.0 | 1.70 | 0.05 | 0.44 |
| **6.33** | 1200 | 2.60 | 0.22 | -0.01 |
| **8.02** | 950.0 | 10.30 | 0.10 | 6.30 |
| **1.50** | 2701 | 0.06 | 1.33 | 0.02 |
| **0.20** | 4800 | 7.11 | 1.42 | -0.85 |

The findings from the real-time engine valve control action to transduce fuel density with vibration sensor are presented with reading values in table 1.0 above. The evaluation captured key parameters such as time, sampling frequency, vibration amplitude for valves limit, density variations within the engine system. The results illustrated above in table 1.0 shows a clear marginal difference in 8.02 seconds (0.12 hertz) to attain stable oscillation flow. The optimal sampling rate was achieved at 1.5 seconds at normal amplitude of 0.06m/s. Inconsistent flow was record from an initial cycling velocities for faulty valves reading from 1.33–1.42 m/s. At 0.20 m/s there was poor sealing of valve due to excessive viscosity. Negative sound and density drift indicated transient low- pressure outcome within the control system which increases wavefront to 4800 Hz.

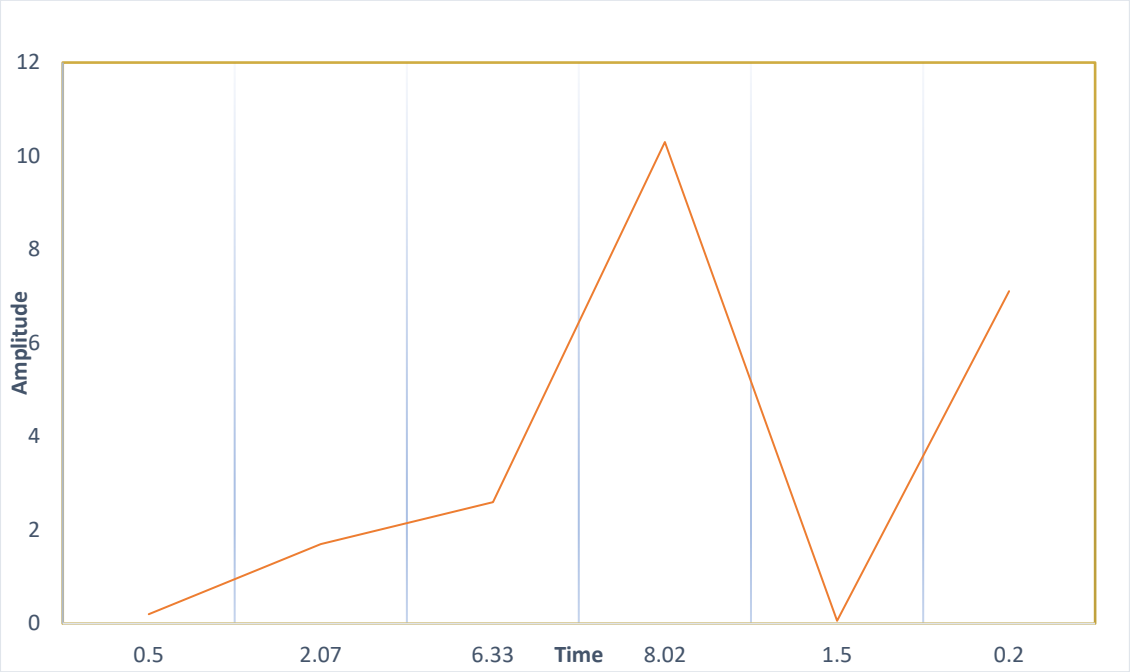



**Figure:1.0. Engine Valve Actuation Signal Rectification**

It was observed that the vibration inside the piston fires with intense compressibility due to unstable pressure. When roughness of the spring decreases the mass flow rate of the system was not optimised at vary temperature. The sound sensor translates the signal into wave pattern as the density in fuel decreases half times due to power loss. The power drops were at zero amplitude when time and vibration was at the lowest peak at 1.50 second with zero amplitude figure 1.0 above. The signal was aliased in figure 1.0 above due to improper rings clearance due to wear and heat generation.

## Conclusion

This research tends to develop self-adjusting sensor integration for efficient valve firing calibration. The engine system can be monitored using elastic air leak fillers and vibration isolator to improve compression ratio.

## Recommendation

A smart flow pulsation valve should be merged in designing valve intake port of automobiles. This can be used to precisely compensate incorrect air-fuel mixture. Also, this will act as pressure relief when the engine valve speed is at zero level.

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