AIR POLLUTION CONTROL FROM DIESEL ENGINES

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Natural Gas Promise for Diesel Engines

The use of natural gas in diesel engines has both economic and environmental advantages. The economic benefit stems from the availability of natural gas in huge quantities in many parts of the world. The use of gaseous fuel locally would save the use of liquid fuels such as diesel or gasoline. Secondly, natural gas gives a high resistance to knock when used as a fuel in internal combustion engines. It is therefore suitable for engines of high compression ratio with possible improvement of thermal efficiency. The environmental advantage stems from the reduced particulate matter in exhaust, as it contains less dissolved impurities (e.g. sulphur compounds) than petroleum fuels, and the low carbon-to-hydrogen ratio of the gas is associated with lower emissions of carbon dioxide.

The use of natural gas in diesel engines is possible by using dual fuel of diesel and natural gas. The gaseous fuel is mixed with the intake air in the intake manifold, which then undergoes a multi-point ignition due to the compression-ignition and combustion of a pilot diesel fuel spray. Then flame propagation occurs through the premixed natural gas mixture. Thus, dual fuel operation with natural gas fuel can yield a high thermal efficiency almost comparable to the diesel engine at higher loads. However, engine performance and emissions suffer at low loads when operating in dual fuel mode. One reason for this is the resulting very lean mixtures at low loads. The lean mixtures are hard to ignite and slow to burn.

EGR Can Improve Engine Performance and Reduce NO_x

The use of Exhaust Gas Recirculation (EGR) is suggested method of improving the engine performance at low load and reducing the emissions of such engines. By increasing the intake charge temperature, hot EGR could promote better combustion. Some of the unburned fuel can be re-burned with this method; however, NOx levels can possibly go up. To counter for this tendency with hot EGR, cooled EGR may be beneficial. NOx levels may be much reduced by using cooled EGR in such engines.

The use of EGR in dual fuel engine is therefore promising method for improving part load operation and reducing the exhaust emissions of NOx. However, when the EGR is used it may change rate of combustion process or the rate of pressure rise inside the combustion chamber, which is related to another dangerous pollutant i.e. the combustion noise.

Noise Pollution in Diesel Engine

Noise is a pollutant by the combustion process that may have direct effect upon observers. It may cause immediate annoyance and physiological change. Combustion noise occurs in two forms, direct and indirect. Direct noise is noise generated in and radiated from a region undergoing turbulent combustion. This is caused by a temporal fluctuation in the aggregate heat release of the reacting region. This overall fluctuation, while small, exists and generates pressure waves. The indirect noise is generated downstream of the combustion region due to interactions between streamlines of different temperatures. Depending on the device, either direct or indirect noise may be dominant. It has also been shown for some time that in

diesel engines, both the pressure - time form and the turbulence - combustion interaction may be important to the noise problem.

Diesel engine is known to produce noise much more than that produced by spark ignition engine. Noise is transmitted throughout the engine block as vibration, which can cause audible noise to human ear at different spectrum of frequencies. Other than airflow and mechanical noise, combustion noise is known to be a main source of noise. This is particularly true for engines that use high compression ratios and the combustion pressure rise is fast. One of the main factors that is known to affect the combustion noise is the pressure rise rate during combustion. It has also been shown that the maximum rate of pressure rise is directly proportional to the sound pressure level in decibel observed in the main chamber of diesel engine. .

Noise Pollution Control in Diesel Engines

Considerable research efforts have been applied to have more smoother and less noisier diesel engines, and works are continuing at the UAE University in relating the diesel engine combustion noise to the engine operating and design parameters. These efforts include the use of Exhaust Gas Recycle, using water-diesel emulsion, using diesel fuel additives to reduce the noise and emissions