Module 6:Emission Control for CI Engines

Lecture 26:An Overview of CI Engine Emission Control

The Lecture Contains:

Previous Next

AN OVERVIEW OF CONTROL OF CI ENGINE EMISSIONS

For emission control in the CI engines, usually called as the diesel engines the following are important;

- CI engines emits pollutants in solid (soot), liquid (poly aromatic hydrocarbons, fuel and oil components, sulphur acids) as well as those in gaseous (CO, HC, NO_x) state.
- Emissions of nitrogen oxides and particulate matter from diesel engines are of main concern.
- Emission regulations do have limits for CO and HC as well from the CI engines, but concentration of their emissions is rather small and these have been relatively easy to control through improved engine and fuel system design.
- NO_x - PM trade off (discussed in Module 2) governs selection and optimization of many engine design variables e.g, injection timing, injection pressure, boost pressure etc as change in some engine variables may although causes reduction in NO_x but increases PM and vice versa.
- Engine design changes to reduce NO_x emissions many a times result also in higher brake specific fuel consumption (BSFC). This is important as the emissions of the greenhouse gas, CO_2 are also to be reduced.

The development efforts like for the SI engines have been focused on reduction of engine-out emissions and treatment of the exhaust gases. Improvements in fuel quality also have been made to meet the needs of advanced emission control technology.

In CI engines, mixture formation and combustion is heterogeneous and complex in nature. It is governed by;

Previous Next

contd...

- Mixture formation which depends on interactions between the injection spray, air motion and combustion chamber geometry.
- Air motion – swirl, squish etc,
- Injection spray formation -precise control of fuel injection process is necessary for formation of the desired spray and fuel atomization.
- Combustion chamber type- Indirect Injection or Direct Injection. The indirect injection engines are being phased out of production due to their poor fuel efficiency.
- Intake boost pressure

Turbocharging especially with variable boost pressure coupled with EGR results in substantial reductions in both the NO_X and PM.

Exhaust aftertreatment such as diesel particulate filter (DPF), diesel oxidation catalysts (DOC), selective catalytic reduction (SCR) of NO_X etc., are already in use.

An overview of various technologies and direction of research and development which have been pursued to control NO_X and PM emissions from the CI engines are presented in Figs. 6.1 and 6.2 respectively.

Previous Next

contd....

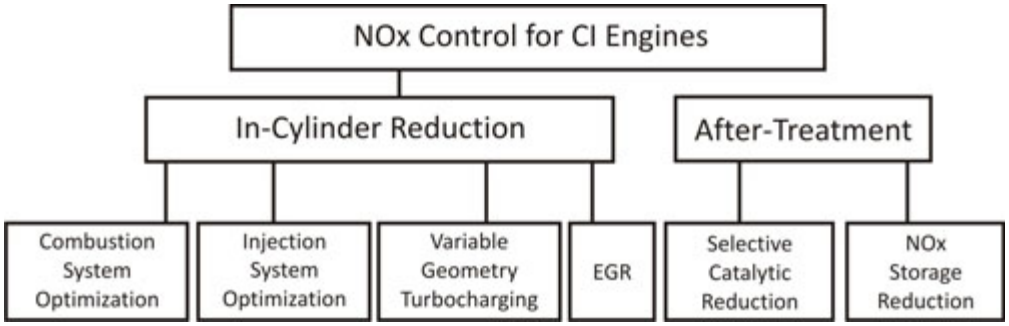

Figure 6.1 An overview of NO_x reduction techniques in CI engines

The technologies used for control of PM emissions are presented on Fig. 6.2.

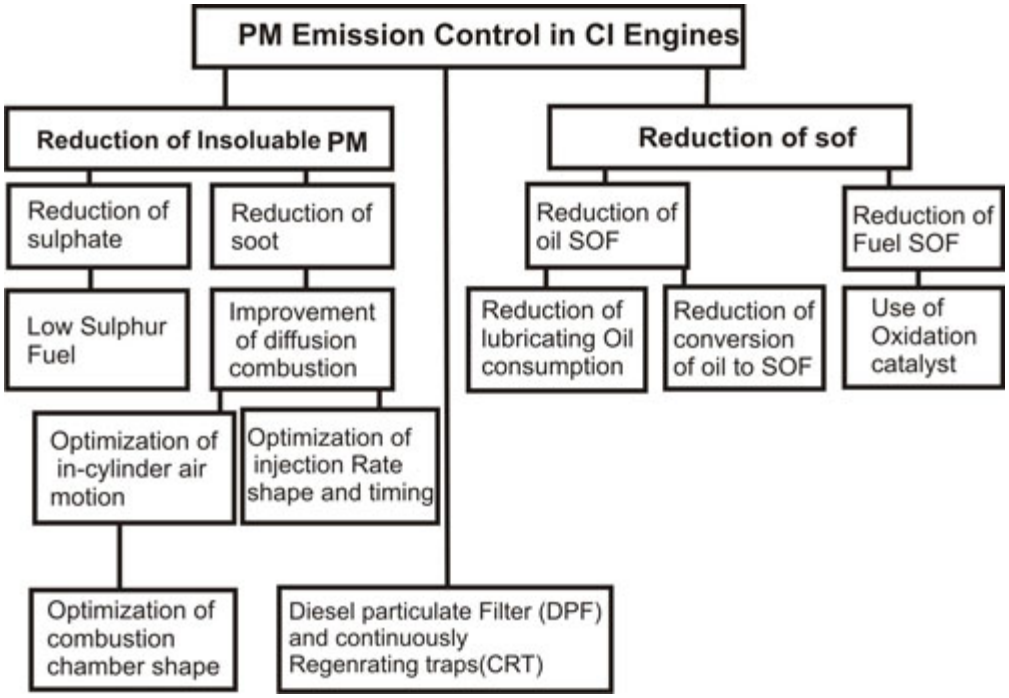

Figure 6.2 An overview of PM reduction techniques in CI engines

Previous Next