ABSTRACT

A four zone model based on the existing two zone model is developed to predict the pressure, temperature and the formation of the pollutants like nitric oxide, carbon monoxide and soot from the fuel injection data and engine geometry. The four zones are fuel zone, stoichiometric burning zone, product/air zone and a non-burning zone outside the spray. The pressure, the convective heat transfer from the non-burning zone, convective and radiative heat transfer from the spray as a whole and the fuel burning rate are calculated based on the two zone model. Equilibrium calculations and the rate kinetics are applied to the stoichiometric combustion zone considering 12 species such as H₂O, H₂, OH, H, N₂, NO, N, CO₂, CO, O₂, O and AR. Fourteen reactions (7 forward and 7 reverse) were considered for the rate calculation of the nitric oxide.

Split Injection method is used for the control of Nitric oxide. In split injection, injection of fuel was divided into two steps, the pilot injection of small quantity and main injection of larger quantity. Different proportions of fuel such as 40-60, 35-65, 30-70, 25-75 and 20-80 and different crank angle intervals between the end of pilot injection and the beginning of main injection such as 3°, 4°, 5°, 6° & 7° were tried. The optimised combination of proportion of 30-70 with crank-angle interval of 5° were established.

Nagle - Strickland constable oxidation mechanism has been adopted in the computer model for predicting the formation and emission of soot.

An exhaustive parametric study was conducted using this four zone model to study the effect of design and operating conditions of engines on the formation of NO, CO and Soot. Similarly the effect of design and
operating conditions of engines on the emission of NO, CO and Soot with 
split injection proportion of 30-70 and gap of 5° crank angle were studied.

An experimental investigation was carried out to access the emission 
levels of three different capacity six cylinder automotive diesel engines.

The predictions by the computer model, and the experimental findings 
are demonstrated. The capability of this model and the comparison of the 
predicted results with experimental findings are highly satisfactory.