

# Calculation on Cylinder Pressure Fluctuation by Using the Wave Equation in KIVA Program

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**Abstract:** Cylinder pressure fluctuation during combustion process of internal combustion engine is closely related to combustion noise and knock. The current studies are based on cylinder pressure test to obtain information on combustion noise and knock, but there is little for simulation of combustion pressure fluctuation. Based on effects of combustion process in the combustion chamber on cylinder pressure by using wave equation, the mechanism of pressure fluctuation during combustion is researched with three-dimensional acoustic wave equation and flow field model of KIVA program. The cylinder pressure fluctuation curve, temperature field and acoustic field are obtained from the coupled calculation of the wave equation and KIVA program. The frequency spectrum analysis is taken with the cylinder pressure oscillation of cylinder pressure measured and calculated. The calculation result is consistent with the experimental result. This indicates that the cylinder pressure fluctuation can be correctly calculated with the wave equation. Analysis of calculation results of temperature field and acoustic field shows that sound field changes faster than flame propagates, and distribution of sound field is more complicated. Combustion pressure oscillation in the diesel engine is under highly unstable condition. This indicates that the combination of cylinder pressure fluctuation model and combustion model is an effective method to study the pressure oscillations and a new method to study the combustion noise and knock.

**Key words:** combustion, pressure oscillation, acoustic pressure, knock, wave equation

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