The problem of diesel engine

- Thermal efficiency
 - Noise

Noise

Vibration

- .
 - Vibration
- Weight saving

Fuel

Consumption

High torque

Exhaust emission



Conflicting issues



Comfortable sound that is not low noise

The purpose of this research

Preceding study:focus on DM 1st ord



Focus on **engine speed** and **the variation** of combustion sound



Make combustion noise that feels comfortable



Content

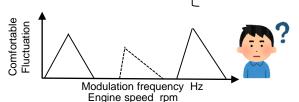
Relationship between comfort and fluctuation by engine speed and variation

Examination of metrics due to the subjective evaluation

Subjective evaluation:

- •SD method
- Paired comparison method

Comfortable Fluctuation



Construction of estimation mode for comfortable at each engine speed

Calculation of estimation model for comfortable at each engine speed by multiple regression analysis

Objective variable: Comfortable Score Explanatory variable:

- Sound pressure fluctuation
- Psychoacoustic evaluation

$$y = \alpha x_1 + \beta x_2 + \gamma x_3 + \cdots + \lambda x_n + C$$



Make comfortable sound by structural change using FEM model

Make comfortable sound by structural change using numerical simulation

Focused on FRF and diesel engine structure





Make the sound of small fluctuation

