# Engine rotation measurement using the engine vibration

Common-rail injection or distributor injection are adopted in recent diesel engines, nowadays. This application shows how to measure the diesel engine rotation by using the engine vibration. This is also effective way for reciprocating engine which vibrates along to the piston movement.
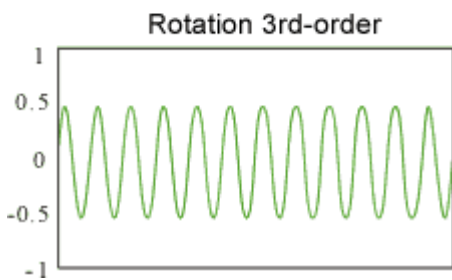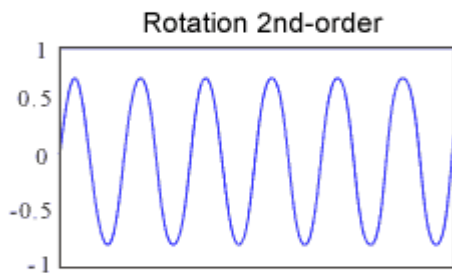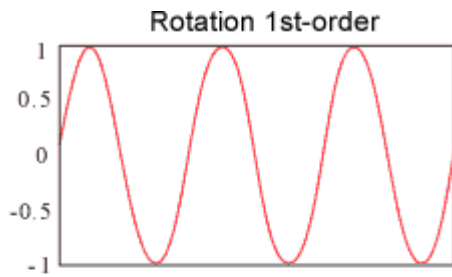
Mount the NP-3331B accelerometer on the engine chassis to detect the engine vibration. On performing FFT analysis, the FT-2500 advanced tachometer can decompose the complicated signals with periodically into the basic (1st) order frequency and integral multiple of the high-order frequency. And then the engine rotation speed can be calculated by the basic frequency.
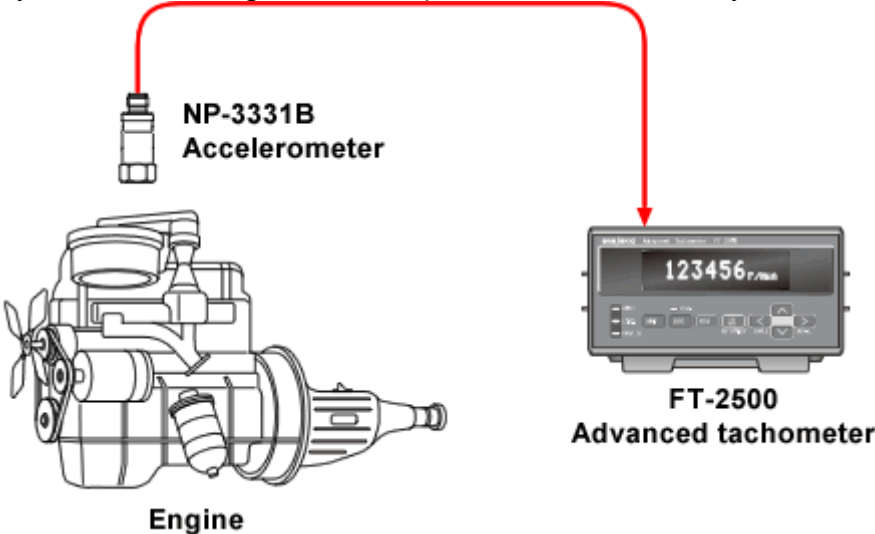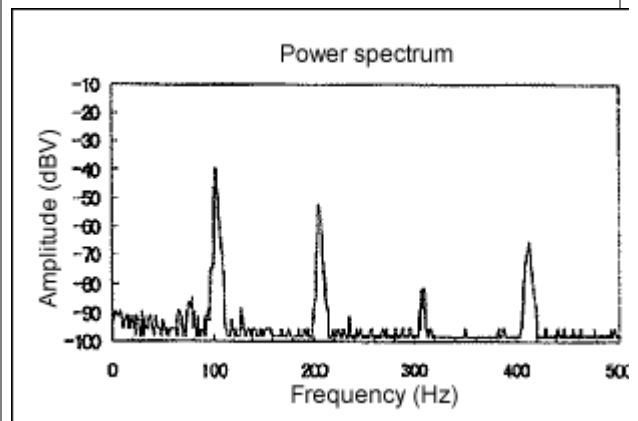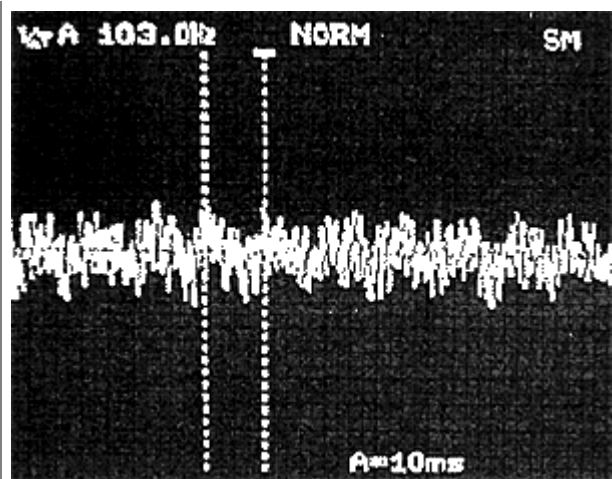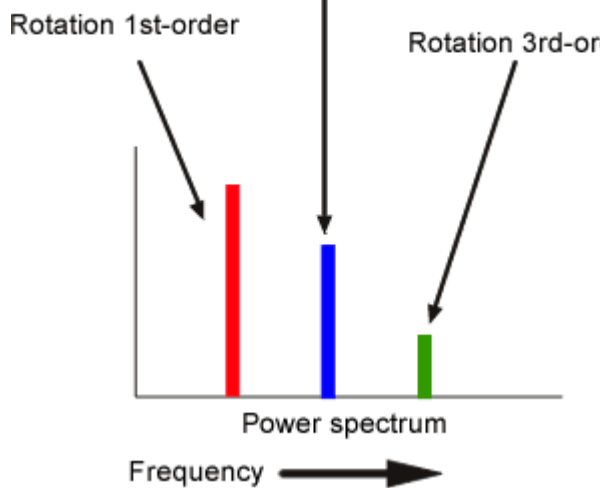

Rotation signal from a sensor
<schematic waveform>

Vibration sensor signal

Time
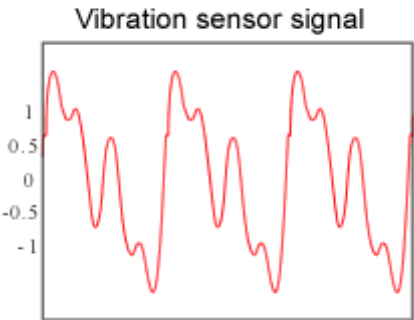
The FFT processing decomposes a complicated waveform with a certain periodicity into basic frequency (1st-order) and high order frequency of the integral multiple. Thereby the power spectrum is obtained at every order of the frequency.
The FT-2500 advanced tachometer is developed by applying this FFT processing technology, which enables to obtain the following power spectrum of the signal from an accelerometer even though it is complicated and minute. With this 1st-order or high order components, the rotation speed can be obtained.

Rotation 1st-order

Rotation 2nd-order

Rotation 3rd-order

Rotation 2nd-order

Rotation 1st-order

Rotation 3rd-or

Power spectrum

Frequency

ピA 103.0Hz   NORM   SM

A=10ms

Power spectrum

Amplitude (dBV)

Frequency (Hz)

Measurement point

The vibration components of an engine differ in horizontal or vertical direction. It needs to find out the most suitable mounting position of the accelerometer for the each engine.

The FT-2500 has filtering function which can cut unnecessary vibration components such as resonance or other vibration factors in the engine rotation of the finished car. With this function, only the required vibration component is obtained. In this application, the filter is set approx. 1.8 times of the estimated rotation speed.

(e.g.) The estimated rotation speed: 3,000 r/min →filter setup value (maximum): 5,400 r/min