講演番号	161

文献番号	20226161

Development of Component Based TPA Method Using 6DOF Virtual Points

Yohei Mukumoto [1)] **Yoshimi Sato** [1)] **Yutaka Nagao** [1)] **Satoshi Ikeda** [1)]
Takehisa Kaneguchi [1)] **Ryota Endo** [1)]

1) ESTECH Corporation
6-50-1 Honcho, Nakaku, Yokohama, Kanagawa, 231-8315 Japan

KEY WORDS: vibration, noise, and ride comfort, idling vibration, transfer path analysis,
6DOF Virtual Point, blocked force, Component Based TPA (B3)

Transfer path analysis (TPA) is a method to predict the contribution of each component such as engine, exhaust system, drive train, and suspension to the evaluation response in the analysis of a vehicle interior noise and vibration.

Component-based TPA, which has been recently used as one of the TPA methods, is characterized by the use of the equivalent force in the assembled state of components, called ‘‘blocked force’’, and the transfer response of the assembled state of components. The blocked force is the specific property of the source component and a major practical advantage utilizing this equivalent force is that it can be evaluated separately from the property of the responding component.

In the experimental measurements of a vehicle in operating condition, the direct measurement of the acceleration on the body and each component of the vehicle is possible by attaching acceleration sensors to the target points, but direct measurements of the transmission force from each component to the body of the vehicle and the excitation force of each component are difficult since they include rotational degrees of freedom. As a specific example, in the case of low-frequency engine vibration problem, rotational components are included in the force transmitted to the knuckle through the drive shaft and the power plant excitation force.

In this paper, the blocked force is calculated for idle vibration under the following two different cases. One is the case which the boundary point of the component is put on the power plant mount of body side and the axle center position of the drive shaft on the knuckle. The other is the case which the boundary point of the component is put on the center of gravity of the power plant. In the former case, it is possible to perform an analysis focusing on the force transmission from the drive shaft to the vehicle body by setting the axle center position on the knuckle as a 6-DOF virtual point, and in the latter case, it is possible to perform analysis focusing on the excitation force of the power plant by setting the center of gravity of the power plant as a 6-DOF virtual point.

Fig. 1, 2 show the calculation results of the blocked force at the axle center position on the left knuckle in D and N ranges under the operating engine idling condition. The calculation results of the blocked force are verified by comparing the TPA synthesis results with measured values of the evaluation response on the vehicle body.

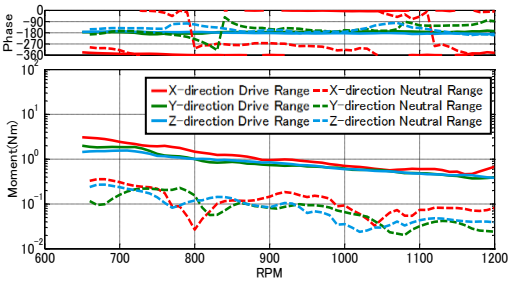

Fig.1 The blocked force in translational direction at the axle center position on the left knuckle

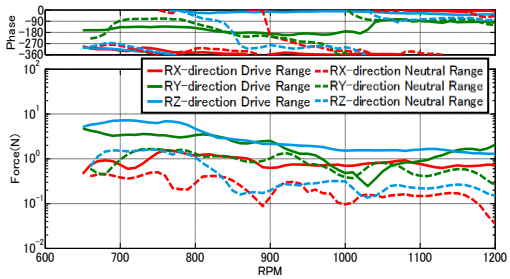

Fig.2 The blocked force in rotational direction at the axle center position on the left knuckle

As an example, the comparison of the acceleration in Z-direction of the assistant seat rail between measured results and the TPA synthesis results in D range is shown in Fig. 3. The TPA synthesis results are basically consistent with measured results, therefore it can be judged that the calculated blocked force is valid. Furthermore, the validity of the blocked force of the power plant obtained by this method is also confirmed.

In conclusion, the validity of the analysis results was confirmed by comparing measured values of the evaluation point response and the TPA synthesis by this method. Moreover, it was shown that the transmitted force and excitation force of components, which are difficult to measure directly, can be substituted by the blocked force of 6 degrees of freedom virtual points.

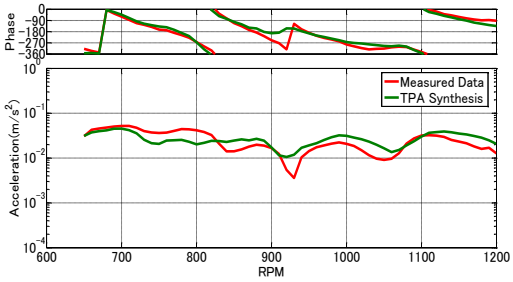

Fig.3 The comparison of the acceleration in Z-direction of the assistant seat rail between measured results and the TPA synthesis in D range