

# Impact of Vibration Applied to the Vehicle by the Hub Nut Clamp Type Vehicle Restraint Device

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A hub nut type vehicle restraint device is used to secure a vehicle on a chassis dynamometer (Fig.1). A different vibration of the vehicle are generated from the vibration on the road, because the wheel hubs of the vehicle are fastened to the chassis dynamometer by several bolts. A simulation model for the vehicle vibration analysis was constructed, and the factors were investigated which are generating vibrations (Fig.2). The flange part for fastening the bolts to the wheel hub is made to have an alignment structure that allows the centering adjustment based on the consideration of the simulation result.

Circular runout and angular misalignment of flange are compared before and after adjustment using triaxial accelerometers installed on the vehicle body. The vibration of the vehicle body is caused by eccentricity (concentricity) of the hub nut flange, which gives the forced excitation vibration to the vehicle body.

Operational Modal Analysis (OMA) confirmed that the natural vibration frequency and the vehicle body are resonating in top-center pitching mode (Fig.3). Top-center pitching mode is a behavior of which rotation center is above the center of gravity. Experimental Modal Analysis (EMA) confirmed the same behavior of the top-center pitching mode as OMA. It was confirmed that the vibration of the top-center pitching mode did not appear when the hub nut clamp type vehicle restraint device was detached.

The vibration reduction shows the possibility of the improvement by reducing the eccentricity of the hub nut flange.



Fig.1 Hub Nut Clamp Type Vehicle Restraint Device

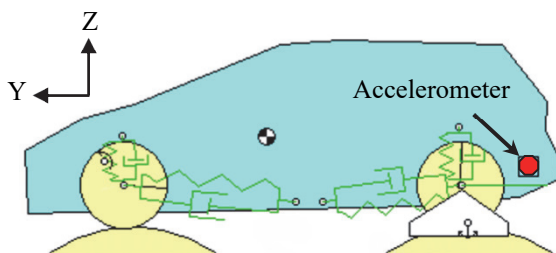


Fig.2 Simulation on CHDY

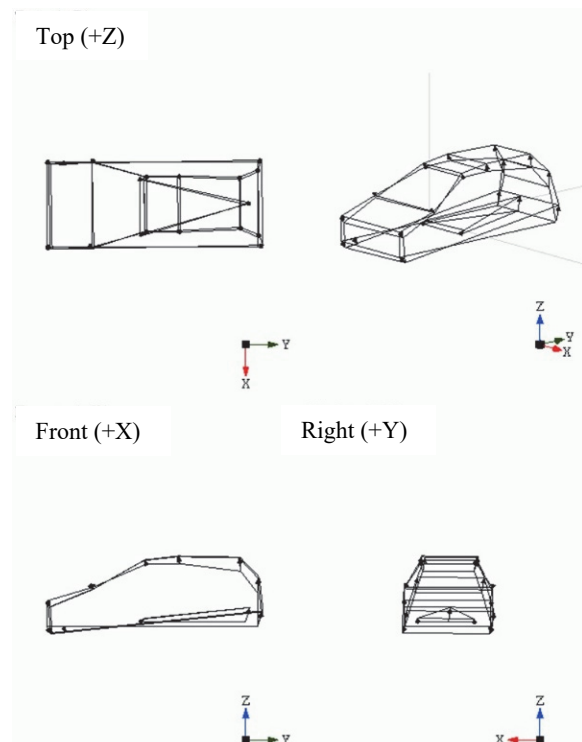


Fig.3 Pitching Mode