Continuously Variable Transmission
for Application in Tuned Mass Damper

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ABSTRACT

Tuned mass dampers (TMD) are well known devices used for vibrations reduction [1]. This technique is widely used in modern architecture. Constructions are tend to oscillate being excited by a strong wind and earthquakes. These extreme weather phenomena are increasingly frequent and put the high risk on the construction stability. Taking into consideration wind as a most frequent and possessing the slow change in the frequency, it is possible to use modified TMDs [2,3,4]. We propose modified TMD with Continuously Variable Transmission (CVT). Such configuration add inertance to the system. Use the CVT gives additional ability to change the natural frequency of the system and allows tuning it for current excitation.

We build laboratory rig to study modified CVT produced by Motovario. Our version of this CVT is modified for our specific propose and its properties vary from original one. We perform several test to examine parameters of the modified CVT. We create mathematical model of the modified variator solving its kinematics and obtain equation of motion. Our consideration starts from control perspective. We obtain correlation of the gear ratio in dependence on rotations of the control knob. Further analysis concern internal motion resistance. In result we prepare precise nonlinear friction functions. Finally we perform oscillatory trapezoidal test simulating operating conditions. Results from experiments are used to create time traces of a position, velocity and the driving torque on the transmission input shaft. To validate prepared mathematical model and friction function we compare driving torque simulation results with experimental data. We obtain good correspondence proving proper modelling and its parameters values.

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