MODELING OF A SUN AND PLANET GEAR MECHANISM

ABSTRACT:

Planetary gear trains can be more compact and efficient as power transmissions than fixed axis gear trains but are also more complicated and less understood in terms of vibration health monitoring. A practical differential planetary gear train, which combines two inputs and one output, is studied using multi-body dynamics software.

Backlash between the sun gear and planet gears are precisely specified to avoid teeth interference and undercut. In order to calculate accurate impact forces, an impact model is chosen. Tooth geometry errors are created on the sun gear. Constraints and contact forces to the model are applied as close as possible to real operating conditions.

Torsional vibration induced by backlash and tooth geometry errors is shown to cause teeth separation and double- sided impacts in unloaded and lightly loaded gearing drives. Planetary gears with only backlash errors are compared to those containing both backlash and tooth defects under different kinematic and loading conditions. Time domain results show that the dynamic responses due to the combination of backlash and tooth defects depend on the interaction of many components of the differential planetary system.