ABSTRACT

In the landing gear dynamics, shimmy and gear walk instability are the most undesirable conditions during the taxiing, take-off and landing ground runs. Gear walk is the cyclic fore and aft motion of the landing gear strut assembly about the vertical strut center line. This friction induced vibration is caused due to lighter shock strut with high material strength, increased strut and wheel flexibility, strong ground reaction from uneven track and smaller brakes with more energy dissipation. Gear walk instability may cause excessive wear of the aircraft components and lead to the catastrophic accidents. It also affects the fatigue life of the aircraft structure, comfort of the passengers and cargo safety.

The fore-aft dynamic response of the aircraft landing gear strut beam during take-off run over an uneven track is brought out in the present study. Gear walk instability induced due to the tire and runway interface friction loads has been analyzed by idealizing the aircraft landing gear into two parts. In the first part the landing gear suspension system has been modeled as a spring-mass-damper system (heave model) with linear stiffness and damping characteristics while in the second part the shock strut transverse stiffness has been modelled by a uniform beam element. The response of the heave model has been investigated with constant velocity ground run for the single sine wave track profile to find out the ground force on the wheel. The response of the heave model has been used as an input for the shock strut beam model. Linear non-homogeneous equations of motion developed for both the models have been solved for the development of the fore-aft dynamic response of the landing gear. A sensitivity study has been conducted by varying the shock strut parameters and track characteristics and their effect on the system response. Also, the dynamic stability of the landing gear strut beam in the fore-aft vibration has been investigated by developing the phase space plots. The study indicates that gear walk dynamics and instability appear when the ground input frequency becomes close to the system fundamental frequency.