

Design and develop an apparatus for measurement of inertial properties for a typical two-wheel motorcycle

ABSTRACT

The inertial properties, both translational and rotational, of an object subjected to motions are crucial information for understanding its dynamics during operation and also design of various practical engineering applications. In the present study, a simple low cost apparatus together with the associated techniques for measuring inertial properties of a motorcycle has been developed. The apparatus was designed to be adapted for a small motorcycle and its variants which typically having an engine capacity of 125 ± 25 cc, a wet mass of about 100 ± 10 kg and a wheelbase of about 1250 ± 50 mm. The apparatus incorporates both the functionalities to determine the CG location, and also the rotational inertia, or the mass moment of inertia (MMI), of motorcycles with respect to the x-, y- and zaxis in orthogonal coordinate system in a few standardized simple steps. The underlying concept of the present designed method are based on a free hanging compound pendulum for locating the CG location of a test object, and based on the theory of periodic oscillation of a pendulum for determining the rotational inertia quantities. The general flow of operation of the measurement was presented, along with the relevant mathematical formulae for calculating the corresponding inertia quantities. Performance of the apparatus was also evaluated and the deviations were found to be within the acceptable range of 2-6%.

Keyword: Centre of gravity; Compound pendulum; Harmonic motion; Mass moment of inertia; Motorcycles; Two-wheelers