ABSTRACT

Any simple to complex machine contains combinations of various mechanisms. These mechanisms are made of assembly of links having relative motions between them. The performance of any mechanism depends on the deformation of links and clearance of joints used in it. The accuracy of dynamic analysis using finite element analysis (FEA) tool depends on the number of elements and its types. The fewer elements facilitate simplicity in modeling and easy to solve the resulting differential equation with less accuracy. However, the complexity of the dynamic analysis of mechanism also depends on the link rigidity.

In this present study the position analysis, kinematic analysis and dynamic analysis of four bar and six bar planar mechanism have been carried out. The theoretical results obtained by MATLAB and ANSYS have been validated with the results available in literature. The effect of the link rigidity on the dynamic analysis of four bar planar mechanism has been studied by considering rigid and flexible links. The linear deformations and angular deformation at each node have been computed through the dynamic model. In this dynamic model each link is assumed as an element. The equations of the motions for this dynamic model have been solved by numerical method using MATLAB software. The increased numbers of elements per link during dynamic analysis using ANSYS software have improved the accuracy of results. In ANSYS analysis the RMS value of coupler strain has improved by 74% as compared to consideration of single element during MATLAB analysis. The good agreement of
simulation results with the experimental results published in literature has proved the effectiveness of methodology.

The dynamic analysis provided the torque requirement of the mechanism at various crank positions. From this analysis it is noticed that the maximum torque is required at 180° crank position. The stiffness of coupler has changed with cross section shape and its orientation. Moreover, increase of rocker length leads to higher coupler strain.

This methodology is also extended for the Watt’s mechanism (six bar mechanism). During the analysis of six bar mechanism, strain in different link has been calculated for different position of crank.

The proposed effective method of dynamic analysis is also suitable for the dynamic analysis of mechanism used in car suspension, six bar linkage prosthetic knee mechanism, six bar lift mechanism for tractor, automobile hood linkage, four bar card feeder mechanism, etc.