To develop accurate diagnostic techniques, this study examines gear dynamic responses based on a model including the frictional effect of tooth mesh process. An 8-DOF (degree-of-freedom) model is developed to include the effect of not only gear dynamics but also supporting bearings, a driving motor and a loading system. Moreover, it takes into account the nonlinearity of both the time varying stiffness and the time-varying forces due to the friction effect. The latter causes additional vibration responses in the direction of the off-line-of-action (OLOA). To show the quantitative effect of the friction, vibration responses are simulated under different friction coefficients. It shows that an increase in friction coefficient value causes a nearly linear increase in the vibration features. However, features from torsional responses and the principal responses in the line-of-action (LOA) show less changes in the vibration level, whereas the most significant increasing is in the OLOA direction. In addition, the second and third harmonics of the meshing frequency are more influenced than the first harmonic component for all motions. These vibration responses are more sensitive for indicating lubrication changes and enhancing conventional diagnostic features.