

12.1: Introduction to Non-inertial Reference Frames

Newton's Laws of motion apply only to inertial frames of reference. Inertial frames of reference make it possible to use either Newton's laws of motion, or Lagrangian, or Hamiltonian mechanics, to develop the necessary equations of motion. There are certain situations where it is more convenient to treat the motion in a non-inertial frame of reference. Examples are motion in frames of reference undergoing translational acceleration, rotating frames of reference, or frames undergoing both translational and rotational motion. This chapter will analyze the behavior of dynamical systems in accelerated frames of reference, especially rotating frames such as on the surface of the Earth. Newtonian mechanics, as well as the Lagrangian and Hamiltonian approaches, will be used to handle motion in non-inertial reference frames by introducing extra inertial forces that correct for the fact that the motion is being treated with respect to a non-inertial reference frame. These inertial forces are often called fictitious even though they appear real in the non-inertial frame. The underlying reasons for each of the inertial forces will be discussed followed by a presentation of important applications.

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