Chapter 1
Introduction to Positioning

Positioning Concepts

Positioning Requirements

Modes of Positioning

A brief look at the rest of the course

Positioning Concepts

- Generally speaking, positioning is the process of determining the coordinates of a static or moving object
  - For simplicity, in this course we only consider positioning in the vicinity of the Earth, but the fundamental principles apply in all cases (e.g., inter-planetary, other planets, etc.)

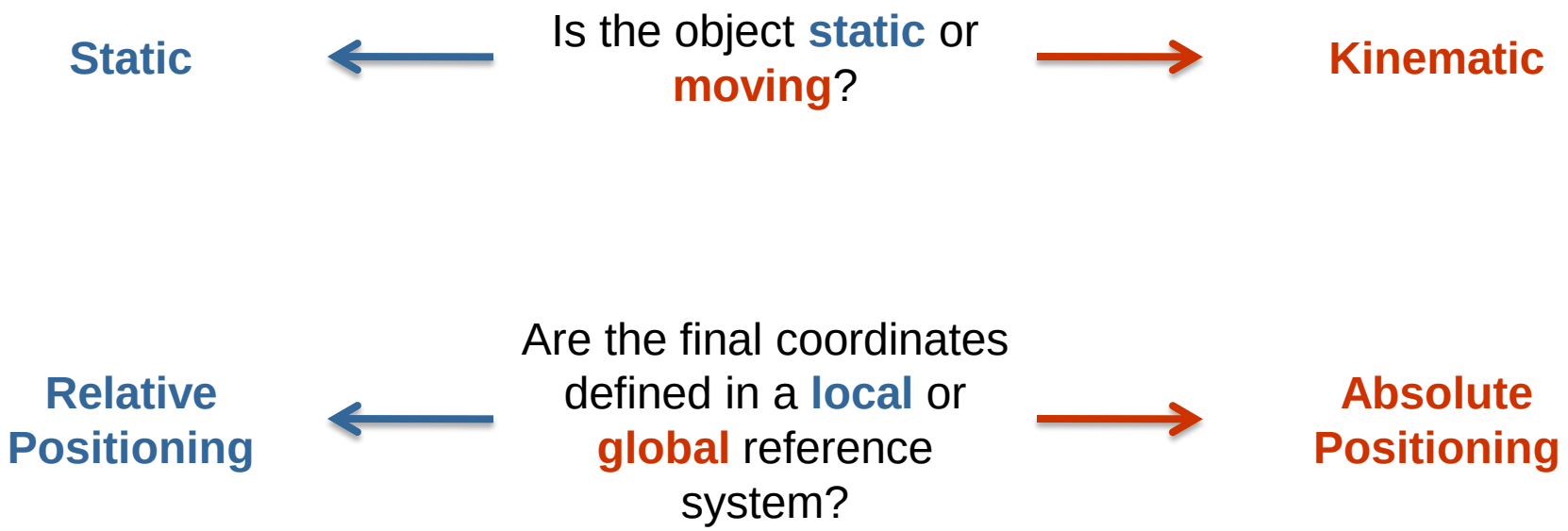
- The object to be positioned can be located on, above or under the Earth's surface

- Positioning is always performed relative to points/objects with a known position
  - Coordinates of these other points may have been computed using other data or may have been "arbitrarily" defined in advance (e.g., this point is the origin)
  - Points may be terrestrially-based (e.g., ground control point) or extra-terrestrially-based (e.g., satellites)

Positioning Requirements

- Measurements from sensors to known point(s)
  - Known points may be
    - Terrestrial or extra-terrestrial
    - Static or moving
  - Sensors may provide a wide range of measurements
- Reference system (coordinate frame) in which to express the coordinates
- Measurement/observation/mathematical model
  - Relates measurements to the unknowns
  - Methods of reducing the errors are also desirable
- Estimation strategies for amalgamating the measurements
  - Least-squares-based algorithms are most common
  - Estimate of solution quality (accuracy) should also be available
- Transformation of results (e.g., to another frame), if necessary

Modes of Positioning



Kinematic vs. Dynamic Positioning

- Dynamics deals with determining the motion of an object based on the forces acting on the object and the mass of the object

- Kinematics deals with determination of motion without considering for the forces acting on a body

- Kinematic positioning, therefore, deals with measuring the position of an object without consideration for the forces acting on the object