Chapter 2
Kinematic Concepts for Analyzing Human Motion

Anatomical Reference Position
- erect standing position with all body parts facing forward
- considered the starting point for all body segment movements

Directional Terms
- superior: closer to the head
- inferior: farther away from the head
- anterior: toward the front of the body
- posterior: toward the back

Directional Terms
- medial: toward the midline of the body
- lateral: away from the midline of the body
  - proximal: closer to the trunk
  - distal: away from the trunk

Directional Terms
- Superficial: towards the surface of the body
- Deep: away from the surface of the body

Reference Planes
- sagittal plane - in which forward and backward movements occur
- frontal plane - in which lateral movements occur
- transverse plane - in which rotational movements occur
Saggital Plane

Saggital Plane Movements

Flexion
Extension
Hyperextension
Dorsiflexion
Plantar flexion

Frontal Plane

What movements occur in the frontal plane?

Abduction
Adduction
Lateral flexion
Elevation
Depression
Radial deviation
Ulnar deviation

Transverse Plane

Transverse Plane Movements

Medial rotation
Lateral rotation
Pronation
Supination
Horizontal adduction
Horizontal abduction
Reference Axes

- **mediolateral** axis - around which rotations in the sagittal plane occur
- **anteroposterior** axis - around which rotations in the frontal plane occur
- **longitudinal** axis - around which rotational movements occur

Mediolateral Axis

Anteroposterior Axis

Longitudinal Axis

Forms of Motion

**Linear** motion: motion along a line
- **Rectilinear** motion: (along a straight line)
- **Curvilinear** motion: (along a curved line)

Angular Motion

rotation around an axis
General Motion

combination of linear and angular motion
(*includes most human motion*)

Mechanical System

* a body or portion of a body that is deliberately chosen by the analyst
  - throwing arm
  - kicking leg
  - trunk during a lift
  - entire body during a vertical jump

Spatial Reference Systems

* useful for standardizing descriptions of human motion
* most commonly used is the Cartesian coordinate system
* human body joint centers are labeled with numerical x and y coordinates

Spatial Reference Systems

Cartesian coordinates of the hip

Spatial Reference Systems

Coordinates can be both positive and negative.

Qualitative Analysis: Prerequisite Knowledge

* What is the purpose of the skill?
* What are the causes of performance errors?
* How can knowledge be gained?
  - experience in performing the skill
  - reading available literature
  - attending conferences and workshops
Qualitative Analysis:
Planning

• What is the question to be answered?

• From what perspective(s) should the movement be viewed?
  • Angle
  • Viewing distance

• How many observations should be taken?

Qualitative Analysis:
Planning

• What plans should be made for:
  • performer attire
  • lighting conditions
  • background
  • use of video

Qualitative Analysis:
Conducting the Analysis

Identify
Question/Problem

Make Decisions

Interpret Observations

Viewing Angle

Viewing Distance

Perform Attire

Environmental Modifications

Use of Video

Visual

Auditory

Collect Observations

Communicate with Performer

End Analysis

Refine Question

Lab

• Identify the 3 reference planes and list 3 movements that primarily occur in each plane

Quiz

study key terms