BTME 3072
Robotics and Automation
Lecture 7

2nd Year

III Semester

Galgotias University

2020-21

Unit I: Introduction to Robotics

- Definition of a Robot –
- Basic Concepts –Robot configurations –
- Types of Robot drives –
- **Basic robot motions** –
- Point to point control –
- Continuous path control.

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Objectives of the lecture

- Basic robot motions to be understand
- Types of the robotic motions are to be discussed

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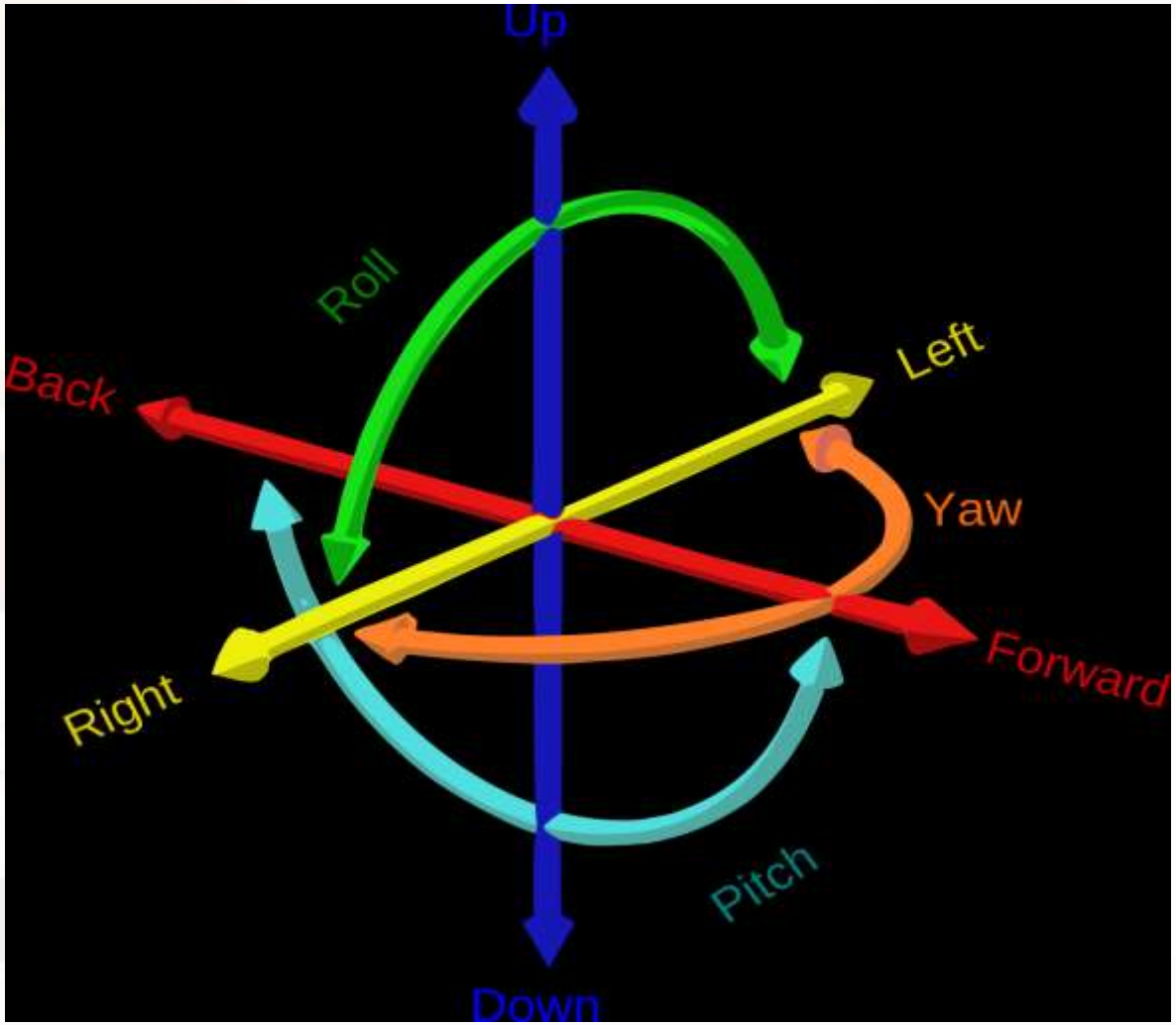
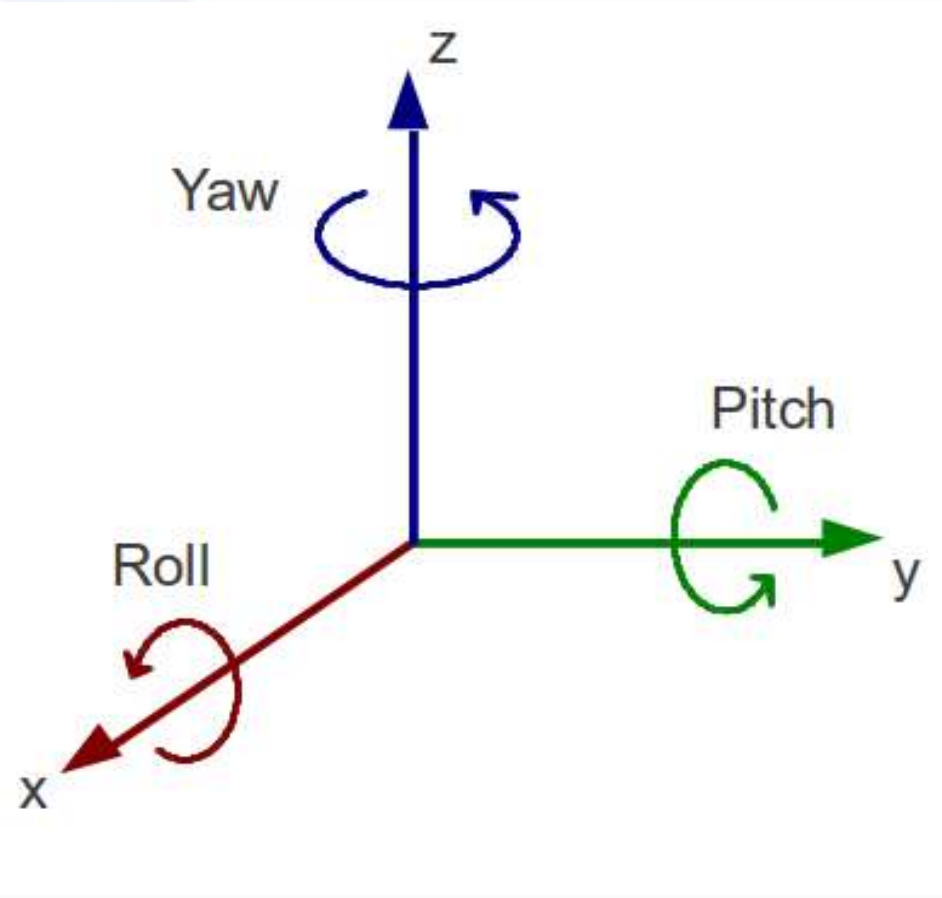
Basic robotic motions

- Vertical motion
- Rapid motion
- Rotational motion
- Pitch motion
- Roll motion
- Yaw



Basic motion

- Rotation around the front-to-back axis is called roll.
- Rotation around the side-to-side axis is called pitch.
- Rotation around the vertical axis is called yaw.



Point-to-point motion

- In point-to-point motion, the end position is designated, but the path used to reach the end position is irrelevant.
- Velocity, time, and acceleration can be defined for point-to-point moves, allowing the controller to construct either a trapezoidal or an s-curve move profile.
- The simplest form of point-to-point motion, referred to as axial or single-axis motion, moves each axis individually.
- For example, to move from point 0,0 (X,Y) to point 120, 300 (X,Y), the X axis would move 120 mm. Then, once the X axis reached its position, the Y axis would move 300 mm.

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- With blended motion, the end of one move profile is joined with, or overlapped by, the beginning of the next move profile to create continuous motion between the two profiles.
- An example of blending is a 90 degree X-Y move in which the Y axis starts to move at a specified time before the X axis completes its move, resulting in a radius instead of a sharp corner.

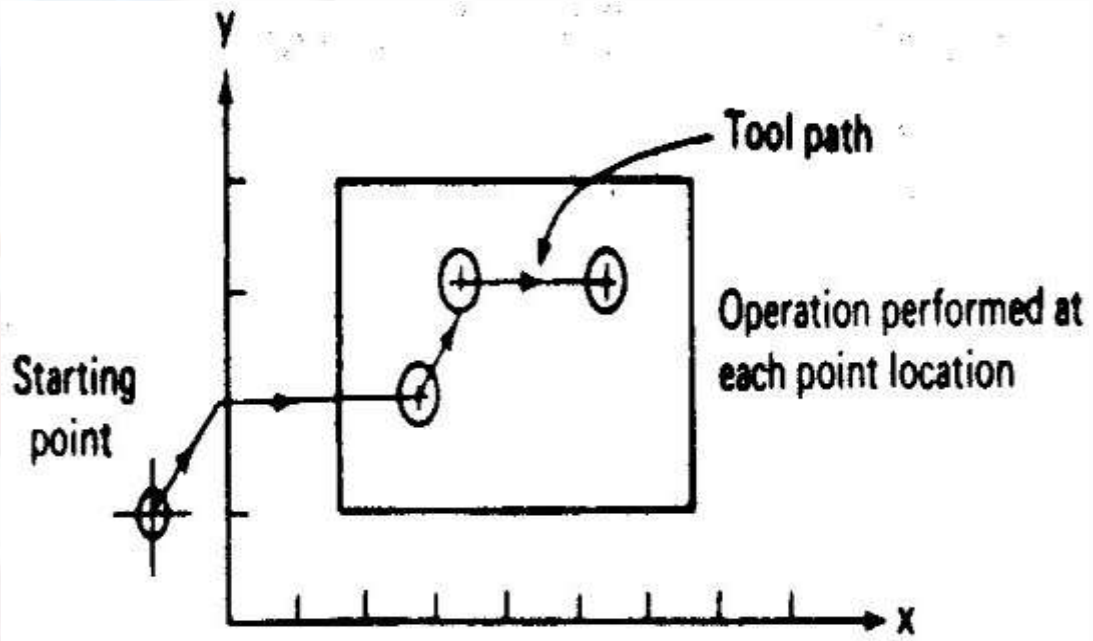

FIGURE 8.5 Point-to-point (positioning) control in NC.

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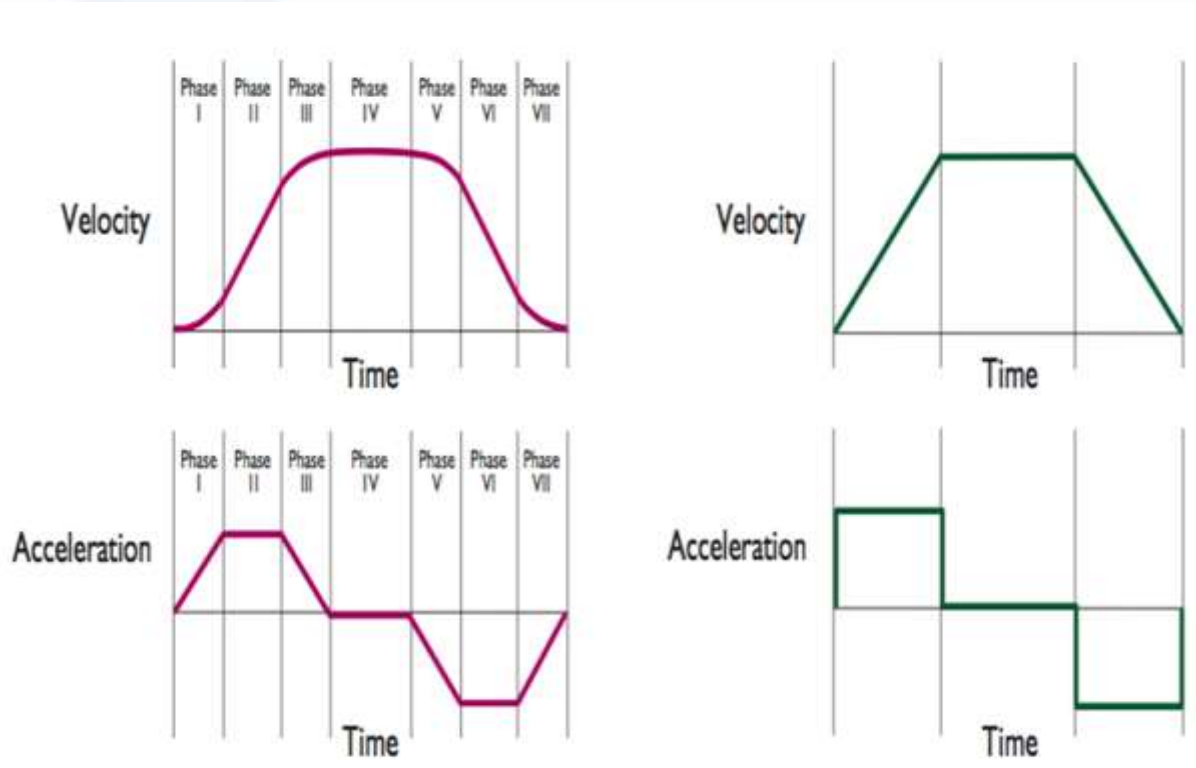
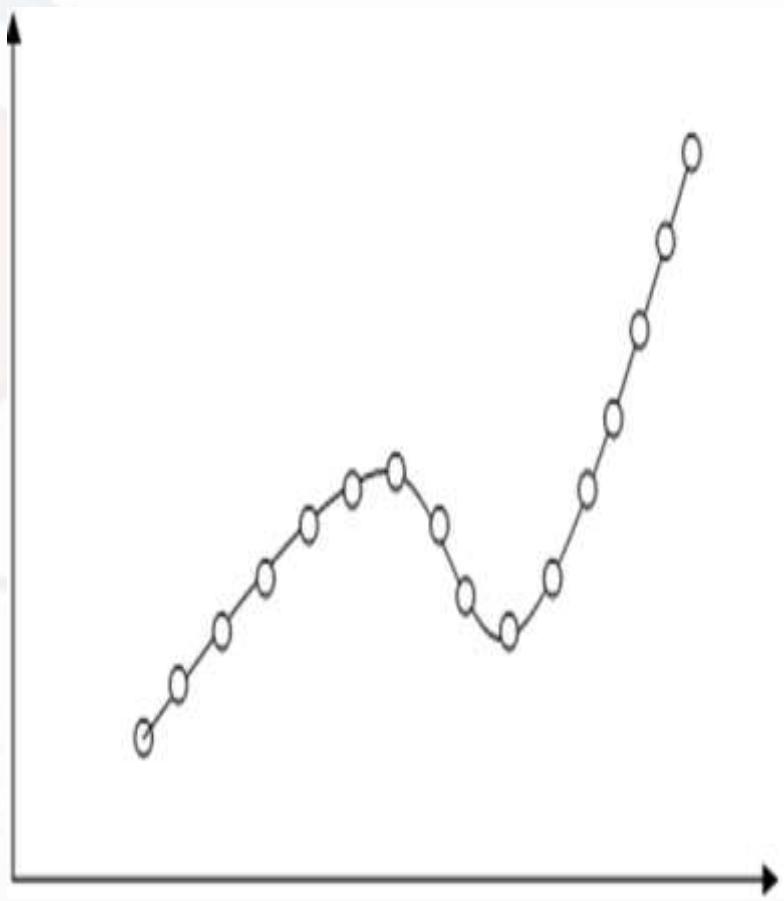
- point-to-point moves can be made with either a trapezoidal or an S-curve move profile.
- A trapezoidal move profile consists of an acceleration phase, a constant velocity phase, and a deceleration phase.
- Because of the sudden end of the acceleration phase, and the sudden beginning of the deceleration phase, trapezoidal profiles can create theoretically infinite jerk.



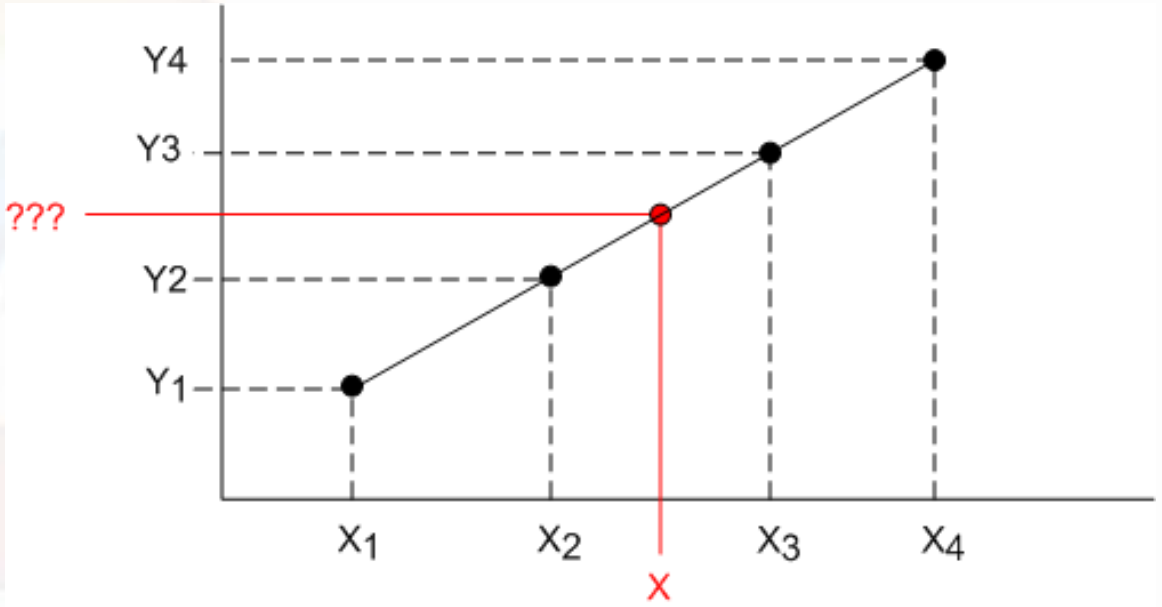
Contouring motion

- To achieve contoured motion, a series of points is provided during programming, and the motion controller extrapolates a smooth line or curve from these points.
- Unlike point-to-point motion, contouring guarantees that the system passes through each point, using either linear or circular interpolation.
- In a contoured move, a time to complete the move is specified, but the actual move profile is determined by the motion controller.



Linear interpolation

- Linear interpolation is used when the desired move is a straight line involving two axes of motion.
- The controller synchronizes the motion of both axes, calculating a series of very small moves along each axis that result in a straight line when executed.
- Keeping with the premise of contouring, linear interpolation ensures that the axes pass through each of the specified points.

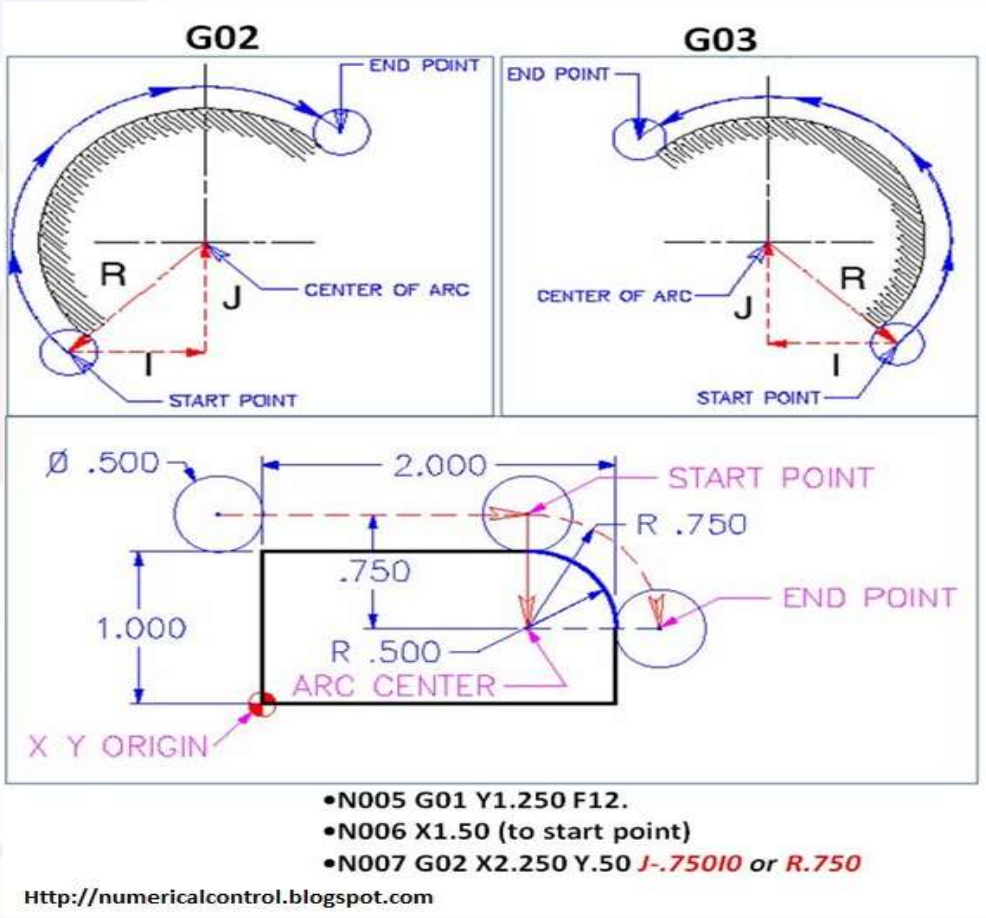


Given a table of data points, (x_i, y_i) and x, find y

Solution: $y = y2 + (x - x2) * \frac{(y3-y2)}{(x3-x2)}$

Circular interpolation

- Circular interpolation works much the same way as linear interpolation, but also requires the specification of a center point, radius, and direction (clockwise or counterclockwise) so that the motion created is circular rather than linear.
- In either type of interpolation, the speed of the movement (linear or circular) is also defined.



Summery

- Linear motion or point to point motion are discussed
- Circular motion are discussed

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Questions

- Briefly explain the basic motions of robotics
- Present the smooth motion of robotics

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Text books

- Introduction to robotics mechanics and control by John J Craig
- Fundamentals of Robotic Mechanical Systems by Jorge Angeles
- Robot Operating System for Absolute Beginners: Robotics Programming Made Easy by Lentin Joseph
- Reference book
  - Robotic process automation
  - Robotic Process Automation For Dummies®, NICE Special Edition

Thank You !