

## NPTEL Video Lecture Topic List - Created by LinuXpert Systems, Chennai

NPTEL Video Course - Mechanical Engineering - NOC:COBOTS: Theory and Practice

Subject Co-ordinator - Prof. Arun Dayal Udai

Co-ordinating Institute - IIT-ISM Dhanbad

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

- Lecture 1 - COBOTS, Its Need and Evolution, Levels of Collaboration, Applications
- Lecture 2 - Collaborative Modes, Contacts, Bio-Mechanical Limits, and ISO Standards
- Lecture 3 - The Process of Risk Assessment
- Lecture 4 - Evolution of Force Control, Technology Transition, and the Hardware
- Lecture 5 - Constrained Motion Task and Distinguishing Features of a COBOT
- Lecture 6 - DC Servo Motors, Position, Velocity and Torque Control
- Lecture 7 - BLDC Motors and PMSM AC Servos
- Lecture 8 - Sensors - Position, Velocity, and Acceleration Sensors
- Lecture 9 - Force/Torque Sensor, Planetary Gearbox and Harmonic Drives
- Lecture 10 - Industrial Field Bus, Drives and Devices, and Safe Workspaces
- Lecture 11 - Degrees of Freedom, Matrix Representations, and Kinematic Transformations
- Lecture 12 - Rotation Matrix, Arbitrary Axis Rotation, and Euler Angles
- Lecture 13 - Robot Frames, DH Parameters, Link Transformation Matrix, and Forward Kinematics
- Lecture 14 - Forward Kinematics of Industrial COBOTS
- Lecture 15 - Inverse Kinematics, Analysis of 2R Planar, 3R Spatial and SCARA
- Lecture 16 - Inverse Kinematic Analysis of a 6-DoF Wrist Partitioned Arm
- Lecture 17 - Inverse Kinematic Analysis of UR Arms
- Lecture 18 - Differential Motion Analysis: Robot Jacobian, Velocity and Acceleration Analysis
- Lecture 19 - Inverse Kinematics of 7-DoF KUKA LBR iiwa Robot and Null Space
- Lecture 20 - Link Forces and Moments
- Lecture 21 - Gravity Compensation, and External Forces/Torques
- Lecture 22 - Kinetostatic Measures for Robot Design
- Lecture 23 - MATLAB Demonstrations
- Lecture 24 - Introduction to Dynamics, LE Approach, Dynamics of 1 DoF System
- Lecture 25 - Dynamic Equation of Motion of a Two-Link Manipulator using Lagrange-Euler (LE) Approach
- Lecture 26 - Introduction to Newton-Euler (NE) and Recursive-NE Approach
- Lecture 27 - Dynamic Equation of Motion of a Two-Link Manipulator using Newton-Euler (NE) Approach
- Lecture 28 - Introduction to Control, Linear Control, Second Order System
- Lecture 29 - Response of a Second Order Linear System

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- Lecture 30 - Transfer Function and State-space representation, ODE
- Lecture 31 - A Robot Joint: DC Motor Model
- Lecture 32 - Feedback control of a robot arm, PID Control, Gain Tuning
- Lecture 33 - External Force Control Loop and Admittance Control
- Lecture 34 - MATLAB Demonstrations - Preparing the 3R Spatial Arm for Force Control
- Lecture 35 - Hybrid and Stiffness Force Controller
- Lecture 36 - Impedance Controller and its variants
- Lecture 37 - Course Conclusion