ChatGPT

Simscape Modeling Examples in Robotics & Automation

- Model and Control a Manipulator Arm with Robotics and Simscape (MathWorks example) – Simulink/Simscape example using an ABB YuMi two-arm robot (single arm) for a pick-and-place task [1]. It demonstrates task scheduling, trajectory generation, and closed-loop control with a Simscape Multibody model of the manipulator and environment.
- Industrial Robot Models in Simscape (MathWorks File Exchange) – A repository of industrial robot models (mobile bases and manipulators) for use with Simscape [2]. Includes examples for importing URDF robot files into Simscape Multibody, performing kinematic/dynamic analysis, integrating electric drives and control algorithms, and planning trajectories with the Robotics System Toolbox [2].
- Pick and Place Robot (Forward/Inverse Kinematics) (MathWorks example) – Simscape Multibody example of a 3-DOF delta robot performing a pick-and-place operation [3]. The robot picks parts with a vacuum gripper, moves them to target locations on a table, and returns home. The example shows how to use `KinematicsSolver` for forward/inverse kinematics and Spatial Contact Force blocks for contact modeling during grasping [3].
- Cartesian Robot Design with Simscape (MathWorks GitHub) – A parametric 3-axis (XYZ) Cartesian robot model for system-level CAD design in Simscape Multibody [4]. Intended for applications like 3D printing or CNC, this project provides a simplified Cartesian robot (gantry or cantilever configuration) with linear stage and column components. It illustrates how to build and analyze such a robot for tasks like trajectory following and work-envelope evaluation [4].
- Articulated Robot Design with Simscape (MathWorks File Exchange) – A system-level parametric articulated robot (serial arm) model for accelerating CAD and mechanical design [5]. The example includes a simplified multi-link arm (with link and gripper components) and supports simulation of tasks like a stacking operation. Custom Simscape library blocks for links, a rotating base, and a two-finger gripper are provided, along with workflows for work-envelope and parameter sensitivity analysis [5] [6].
- Position Control Servo Valve (MathWorks example) – Simscape Fluids example of a closed-loop electrohydraulic servo valve controlling an actuator position [7]. The model includes a torque motor, flapper-nozzle amplifier, and spool valve. It shows how to model the valve body dynamics, flapper-nozzle circuit, and nested PID control loops (current, velocity, position) to achieve precise actuator positioning under small electrical signals [7].
- Pneumatic Actuation Circuit (MathWorks example) – Simscape Foundation library example of a controlled pneumatic actuator system [8]. It features a directional control valve (modeled with gas flow restriction blocks) driving a double-acting pneumatic cylinder (modeled with translational converters). The simulation shows the valve spool cycling to extend/retract the cylinder, with orifices opening/closing and thermal convection in pipes for heat dissipation [9].
- Modeling Pneumatic Robot Actuators (MathWorks File Exchange) – A Simscape/Simscape Multibody example set (by the Simulink Student Competitions team) demonstrating pneumatic actuation in robotics contexts [10]. The included models show how to build pneumatic systems (e.g. a mechanism throwing a ball to a target) using Simscape Multibody contact forces, with PID control of the actuator.

The entry reinforces concepts of pneumatic circuit modeling (orifices, valves, chambers) and coupling with multibody dynamics [10].

- *"Simulating Pneumatic Robot Actuators"* (MathWorks Video) – A Robotics Arena tutorial video on modeling a pneumatic system in Simscape [11]. It shows how to build a pneumatic circuit using Simscape physical blocks: constant-volume chambers, directional control valves, and translational converters. The presenters include thermal convection modeling in pipes and compare load position and chamber pressure responses under different conditions [11].
- *Applications and Tasks in Simscape Multibody* (MathWorks Video) – A MathWorks overview video highlighting industrial applications of Simscape Multibody [12] [13]. It describes a production pick-and-place system where a robot (imported from CAD) moves parts between conveyor belts, integrated with Stateflow task scheduling and Simscape Electrical drives [12]. The video also covers hydraulic applications: a backhoe arm driven by three Simscape Fluids hydraulic actuators, and a cable-driven tower crane (with pulleys and cables) to lift and trolley a load [13].
- Backhoe Model in Simscape (MathWorks File Exchange) – A Simscape model of a backhoe construction vehicle with hydraulics [14]. The model includes Simscape Fluids components (pump, valves, cylinders) that actuate the arm and bucket links, and full multibody dynamics for the 3D mechanism. The example demonstrates custom hydraulic valves, tuning of controllers and system parameters, and even generation of C code from the model [14].
- Scissor Lift Model in Simscape Multibody (MathWorks File Exchange) – A parameterized scissor-lift mechanism with hydraulic actuation [15]. Built using Simscape Multibody and Simscape Fluids, the model is composed of reusable component blocks (links, joints, hydraulics). Intermediate models illustrate the step-by-step construction. A MATLAB GUI lets users interactively change lift dimensions to analyze different designs [15].
- Boom Lift Model with Simscape (MathWorks GitHub) – A telescoping boom-lift (cherry picker) model with extensive hydraulics [16] [17]. CAD geometry (chassis, boom) is imported for accurate mass/inertia and includes effects like ground contact, worm gears, cables, and flexible bodies [16]. It has six hydraulic actuators on the chassis and seven in the boom. The example integrates hydraulic valve blocks, pipelines, and actuators with the multibody model, supporting separate testing of each actuator system as well as full hydromechanical integration with a controller [16] [17].
- Robot Arm with Conveyor Belts (MathWorks File Exchange) – A Simscape Multibody example of a 5-DOF articulated robot picking parts from one conveyor and placing them on another [18]. Created in CAD (Onshape) and imported, the model includes electrical actuators and supervisory logic for the pick/place workflow. It is used to study trajectory optimization and part-transfer tasks between conveyor lines [18].
- Simscape Vehicle Templates (MathWorks Resources) – A set of Simscape libraries and apps for modeling and simulating ground vehicles, including multi-axle and trailer configurations [19]. These templates provide a modular vehicle model (configurable powertrain, driveline, suspensions) and test scenarios (road profiles, ADAS). They can be used to build custom wheeled platforms such as Automated Guided Vehicles, enabling simulation of dynamics and control algorithms in a unified Simscape environment [19].

Sources: Authoritative examples from MATLAB/Simulink documentation, File Exchange entries, and MathWorks repositories have been cited above [1] [2] [3] [7] [9] [10] [11] [20] [14] [15] [21] [18] [19]. Each link points to the official example or project page containing downloadable models and detailed descriptions.

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1 Model and Control a Manipulator Arm with Robotics and Simscape - MATLAB & Simulink
https://www.mathworks.com/help/robotics/ug/model-and-control-a-manipulator-arm-with-simscape.html

2 Industrial Robot Models in Simscape - File Exchange - MATLAB Central
https://www.mathworks.com/matlabcentral/fileexchange/97312-industrial-robot-models-in-simscape

3 Pick and Place Robot Using Forward and Inverse Kinematics - MATLAB & Simulink
https://www.mathworks.com/help/sm/ug/pick-and-place-robot.html

4 GitHub - simscape/Cartesian-Robot-Design-Simscape: This repository shows how to create a system-level parametric Cartesian robot model to accelerate Computer Aided Design (CAD) development.
https://github.com/simscape/Cartesian-Robot-Design-Simscape

5 Articulated Robot Design with Simscape - File Exchange - MATLAB Central
https://www.mathworks.com/matlabcentral/fileexchange/161506-articulated-robot-design-with-simscape

6 GitHub - simscape/Articulated-Robot-Simscape: This repository shows how to create a system-level parametric articulated robot model to accelerate Computer Aided Design (CAD) development.
https://github.com/simscape/Articulated-Robot-Simscape

7 Position Control Servo Valve - MATLAB & Simulink
https://www.mathworks.com/help/hydro/ug/position-control-servo-valve.html

8 9 Pneumatic Actuation Circuit - MATLAB & Simulink
https://www.mathworks.com/help/simscape/ug/pneumatic-actuation-circuit.html

10 Modeling Pneumatic Robot Actuators - File Exchange - MATLAB Central
https://www.mathworks.com/matlabcentral/fileexchange/69331-modeling-pneumatic-robot-actuators?s_tid=prof_contriblnk

11 Simulating Pneumatic Robot Actuators - MATLAB & Simulink
https://www.mathworks.com/videos/matlab-and-simulink-robotics-arena-modeling-pneumatic-robot-actuators-part-1-1542190287608.html

12 13 20 Applications and Tasks in Simscape Multibody - MATLAB & Simulink
https://www.mathworks.com/videos/applications-and-tasks-in-simmechanics-68844.html

14 Backhoe Model in Simscape - File Exchange - MATLAB Central
https://www.mathworks.com/matlabcentral/fileexchange/39520-backhoe-model-in-simscape

15 Scissor Lift Model in Simscape Multibody - File Exchange - MATLAB Central
https://www.mathworks.com/matlabcentral/fileexchange/36553-scissor-lift-model-in-simscape-multibody

16 17 21 GitHub - mathworks/Boom-Lift-Model-Simscape: Telescoping boom lift with tread drive.
https://github.com/mathworks/Boom-Lift-Model-Simscape

18 Robot Arm with Conveyor Belts - File Exchange - MATLAB Central
https://www.mathworks.com/matlabcentral/fileexchange/61370-robot-arm-with-conveyor-belts

19 Vehicle Simulation – MATLAB and Simulink - MATLAB & Simulink
https://www.mathworks.com/solutions/physical-modeling/simscape-vehicle-templates.html