California State University, Chico
Department of Mechanical Engineering, Mechatronic Engineering,
and Sustainable Manufacturing
SMFG 386 – Manufacturing Automation
Laboratory -1 – Robotics
Simulation and Digital Twin with CoppeliaSim (former VREP)

CoppeliaSim is a powerful cross-platform robot simulator which has a free educational version. CoppeliaSim's strength comes from several features:

1. CoppeliaSim provides a unified framework combining many powerful internal and external libraries that are often useful for robotics simulations. This includes dynamic simulation engines, forward/ inverse kinematics tools, collision detection libraries, vision sensor simulations, path planning, Graphical User Interface (GUI) development tools, and built-in models of many common robots.

2. CoppeliaSim is highly extensible. CoppeliaSim developers provide an API that allows one to write plugins that add new features. You can embed LUA scripts directly into a simulation scene that, for example process simulated sensor data, run control algorithms, implement user interfaces, or even send data to a physical robot for hardware-int-the-loop testing. They also provide a remote API that allows one to develop applications in many programming languages that are able to pass data in and out a running CoppeliaSim simulation.

3. CoppeliaSim is cross-platform, mostly open-source, and provides a free educational license.

The purpose of this page is not to teach you how to use CoppeliaSim. Rather it is to describe demonstration scenes that have been developed to support learning for manufacturing automation.

Simulations are typically used for design, and in certain cases, offline optimization. Digital twins, on the contrary, are used for the entire design-execute-change-decommission lifecycle in real-time or offline as hardware-in-the-loop or software-in-the-loop manner.

Pre-Lab

1- Please make sure that you complete the installation of Coppelia Sim. You can follow the instructions in /Course Content/Software/VREP

Post-Lab

1- Complete the Robotics Section of Omron Quiz.
2- List available example scenes and models. Pick three examples related to

Lab

1- Complete the Crane sample from /Course Content/Software/VREP
2- Build 6-DoF Robotic System (if you cannot finish this in time please add that to post-lab).