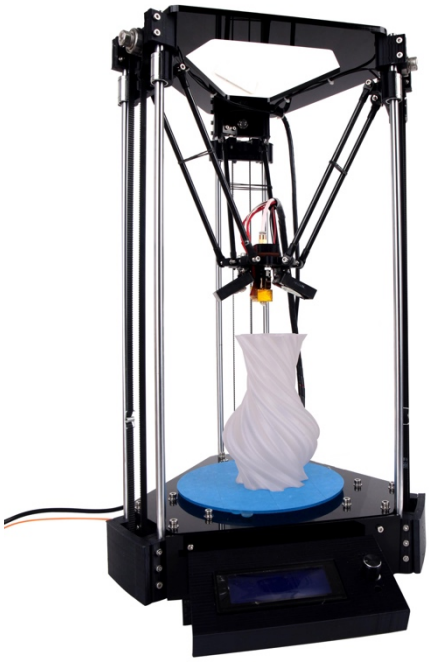
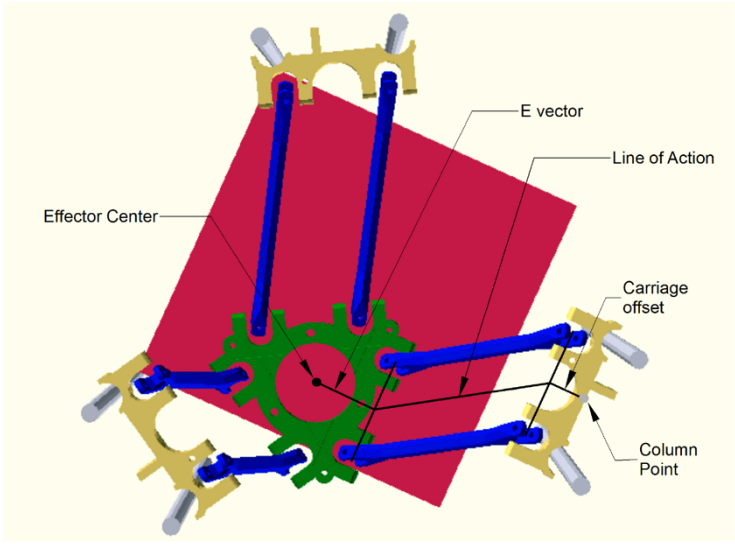
Robotics – MECH 641

Due date: Mar 3, 2017

Parallel robots are very popular in the industry for pick and place application given their high speeds, acceptable accuracy, and rigidity. The FDM 3D printing industry tried to integrate parallel robots by introducing delta 3D printers. While Cartesian printers are simpler in terms of control and equations, delta 3D printers do provide higher speeds that are impossible to reach with Cartesian robots. The simplicity of the mechanical design made it a less expensive and easier to build alternative to Cartesian printers especially in the Reprap open-source community.





The biggest disadvantage of these printers is the nonlinearity as the actuation happens linearly on three different vertical actuators, clocked at 120 degrees around the Z axis of the robot. Each of the actuated carriages (shown in yellow) has two parallel arms (shown in blue) that all connect to the end effector plate (shown in green), where the printing head is attached.

The length of vertical linear prismatic joints is 1000mm and they are clocked on a circle of dimeter 500mm. All blue links have spherical joints on each end. Each blue link is 300mm long. Finally, assume that the blue links attach to green platform at a circle with diameter 150mm.

In Mathematica, do the following:

- Solve the inverse kinematics
- Solve the forward kinematics

For each solution draw the entire 3D manipulator and animate the manipulator using the function **`Manipulate[]`**