

E11: Autonomous Vehicles

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Lecture 4: Design Representation & Gold Codes

This lecture covers two topics that you will need on upcoming labs and problem sets. We will begin with how to represent a 3-dimensional object using two-dimensional views. This will help you visualize your robot chassis as you view it from various directions. Then we will discuss Gold codes, which are used in data communication systems. You will program your robot to lock onto beacons flashing Gold codes.

1. DESIGN REPRESENTATION

Engineers represent 3-dimensional objects on paper with 2-dimensional views showing what the object would look like from various directions. Over the years, we have developed various methods of projecting an object from 3-space onto 2-space.

An *orthographic projection* describes an object with a front view, top view, and side view. Views generally involve solid lines describing the outline of the object and dashed lines representing hidden surfaces. Figure 1 shows these views for a rectangular block with a hole. An asymmetric object might benefit from views of the other three sides.

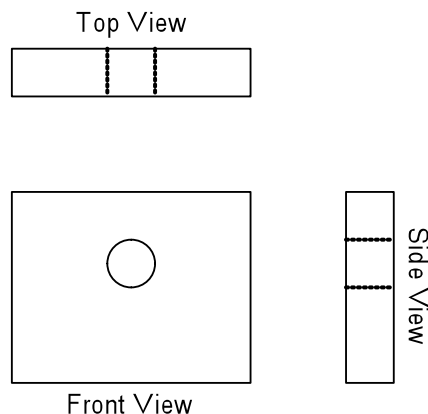


Figure 1 Views of a rectangular block with hole

An *isometric projection* (“same distance”) shows the entire 3-dimensional object in one view, as illustrated in Figure 2. The z axis runs vertically, but the x and y axes are drawn offset by 60 degrees from z in the projection. Distances along the three axes are preserved.

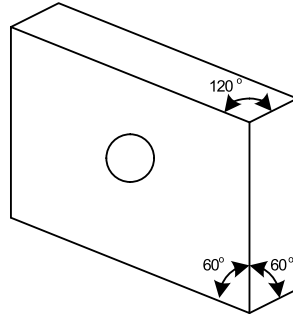


Figure 2 Isometric projection of block with hole

Computer-Aided Design (CAD) tools such as SolidWorks and AutoCAD have replaced drafting tables for drawing representations of designs. CAD tools can be linked to Computer-Aided Manufacturing (CAM) software to drive computer numerical control (CNC) machine tools and three-dimensional printers to automatically manufacture high-precision objects.

Figure 3 shows the isometric projection and three views of an I-beam with two round holes.