

Using UCS to Place 3D Polyline

It is much simpler to use a 3D *Polyline* to create the 3D pentagon. The *UCS* class is handy for this example and all kind of 3D operations.

```
# Using an UCS simplifies 3D operations, but UCS definition can happen later
# calculating corner points in local (UCS) coordinates without Vec3 class
angle = math.radians(360 / 5)
corners_ucs = [(math.cos(angle * n), math.sin(angle * n), 0) for n in range(5)]

# let's do some transformations
tmatrix = Matrix44.chain( # creating a transformation matrix
    Matrix44.z_rotate(math.radians(15)), # 1. rotation around z-axis
    Matrix44.translate(0, .333, .333), # 2. translation
```

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```

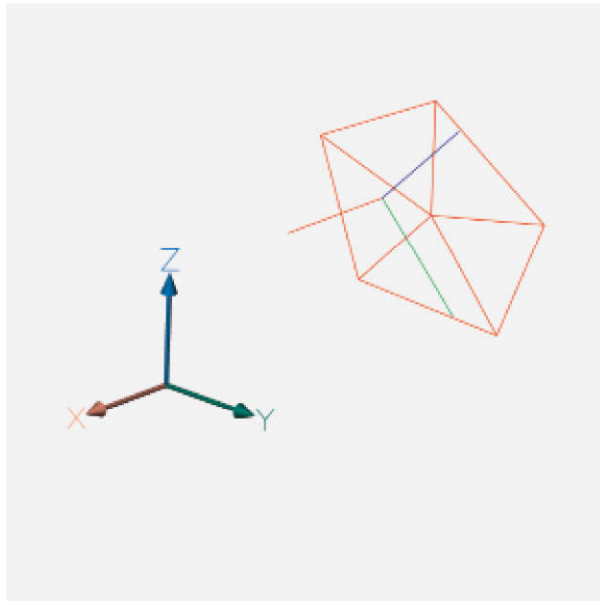
)
transformed_corners_ucs = tmatrix.transform_vertices(corners_ucs)

# transform UCS into WCS
ucs = UCS(
    origin=(0, 2, 2), # center of pentagon
    ux=(1, 0, 0), # x-axis parallel to WCS x-axis
    uz=(0, 1, 1), # z-axis
)
corners_wcs = list(ucs.points_to_wcs(transformed_corners_ucs))

msp.add_polyline3d(
    points=corners_wcs,
    dxfattribs={
        'closed': True,
        'color': 1,
    })

# add lines from center to corners
center_wcs = ucs.to_wcs((0, .333, .333))
for corner in corners_wcs:
    msp.add_line(center_wcs, corner, dxfattribs={'color': 1})

```



Placing 2D Text in 3D Space

The problem by placing text in 3D space is the text rotation, which is always counter clockwise around the OCS z-axis, and 0 degree is in direction of the positive OCS x-axis, and the OCS x-axis is calculated by the *Arbitrary Axis Algorithm*.

Calculate the OCS rotation angle by converting the TEXT rotation angle (in UCS or WCS) into a vector or begin with text direction as vector, transform this direction vector into OCS and convert the OCS vector back into an angle in the OCS xy-plane (see example), this procedure is available as `UCS.to_ocs_angle_deg()` or `UCS.to_ocs_angle_rad()`.

AutoCAD supports thickness for the TEXT entity only for *.shx* fonts and not for true type fonts.