TRANSFORMACIONES GRAFICAS

rotación alrededor del origen)

```
if self.input.isKeyPressed("q"):
        m = Matrix.makeRotationZ(turnAmount)
         self.modelMatrix.data = m @
self.modelMatrix.data
if self.input.isKeyPressed("e"):
         m = Matrix.makeRotationZ(-turnAmount)
        self.modelMatrix.data = m @
self.modelMatrix.data
```

rotación alrededor del centro del objeto

```
if self.input.isKeyPressed("u"):
    m = Matrix.makeRotationZ(turnAmount)
    self.modelMatrix.data = self.modelMatrix.data @ m
if self.input.isKeyPressed("o"):
    m = Matrix.makeRotationZ(-turnAmount)
    self.modelMatrix.data = self.modelMatrix.data @ m
```

```
@staticmethod
def makeRotationZ(angle):
    c = cos(angle)
    s = sin(angle)
    return numpy.array([[c, -s, 0, 0],
                        [s, c, 0, 0],
                        [0, 0, 1, 0],
                        [0, 0, 0, 1]]).astype(float)
```

Traslacion del origen

```
if self.input.isKeyPressed("w"):
    m = Matrix.makeTranslation(0, moveAmount, 0)
    self.modelMatrix.data = m @ self.modelMatrix.data
if self.input.isKeyPressed("s"):
    m = Matrix.makeTranslation(0, -moveAmount, 0)
    self.modelMatrix.data = m @ self.modelMatrix.data
if self.input.isKeyPressed("a"):
    m = Matrix.makeTranslation(-moveAmount, 0, 0)
    self.modelMatrix.data = m @ self.modelMatrix.data
if self.input.isKeyPressed("d"):
    m = Matrix.makeTranslation(moveAmount, 0, 0)
    self.modelMatrix.data = m @ self.modelMatrix.data
if self.input.isKeyPressed("z"):
    m = Matrix.makeTranslation(0, 0, moveAmount)
    self.modelMatrix.data = m @ self.modelMatrix.data
if self.input.isKeyPressed("x"):
    m = Matrix.makeTranslation(0, 0, -moveAmount)
    self.modelMatrix.data = m @ self.modelMatrix.data
```

```
@staticmethod
def makeTranslation(x, y, z):
    return numpy.array([[1, 0, 0, x],
                        [0, 1, 0, y],
                        [0, 0, 1, z],
                        [0, 0, 0, 1]]).astype(float)
```

Traslacion del centro del objeto

```
if self.input.isKeyPressed("i"):
    m = Matrix.makeTranslation(0,
moveAmount, 0)
    self.modelMatrix.data =
self.modelMatrix.data @ m
if self.input.isKeyPressed("k"):
    m = Matrix.makeTranslation(0,
-moveAmount, 0)
    self.modelMatrix.data =
self.modelMatrix.data @ m
if self.input.isKeyPressed("j"):
    m =
Matrix.makeTranslation(-moveAmount,
0, 0)
    self.modelMatrix.data =
self.modelMatrix.data @ m
if self.input.isKeyPressed("l"):
    m =
Matrix.makeTranslation(moveAmount,
0, 0)
    self.modelMatrix.data =
self.modelMatrix.data @ m
```