

```

#!/usr/bin/env python

from numpy import *

def ecef2enu(lat, lon):
#=====+
# ecef2enu : Generate the rotation matrix used to express a vector written in
#             ECEF coordinates as a vector written in local east, north, up
#             (ENU) coordinates at the position defined by geodetic latitude
#             and longitude.
# INPUTS
#
# lat (phi)  ----- geodetic latitude in radians
#
# lon (lamda) ----- longitude in radians
#
#
# OUTPUTS
#
# R ----- 3-by-3 rotation matrix that maps a vector v_ecef expressed in the
# ECEF reference frame to a vector v_enu expressed in the local
# east, north, up (vertical) reference frame as follows:
# v_enu = R*v_ecef.
#
#-----+
# References:
#   1:  Fundamentals of inertial Navigation, Satellite-based Positioning and their Integration
#       Noureldin, A; Karamat, T.B.; Gregory, J.
#       2013, XVIII, 314p. Hardcover
#       ISBN: 978-3-642-30465-1
#       Site: http://www.springer.com/978-3-642-30465-1 ### Needs clarification ##
#
# Author: Caleb North
#=====+

    R = array([
        [ -sin(lon),          cos(lon),          0.],
        [-sin(lat)*cos(lon), -sin(lat)*sin(lon), cos(lat)],
        [ cos(lat)*cos(lon),  cos(lat)*sin(lon), sin(lat)]
    ])

    return (R)

```