npod

November 9, 2024

[ ]:
```
from collections import namedtuple
import sympy
from sympy import Matrix, det, symbols, sin, cos, pi
```

[ ]:
```
TrackingWheelCfg = namedtuple('TrackingWheelCfg', ['v', 'theta_rad',␣
 ↪'radius_meters'])
```

[ ]:
```
e_x = Matrix([[1],[0]])
e_y = Matrix([[0],[1]])
```

[ ]:
```
def xfactor(r, theta):
    return 1.0 / (r * cos(theta))

def yfactor(r, theta):
    return 1.0 / (r * sin(theta))


def ofactor(r, v: Matrix, d: Matrix):
    rotMat = Matrix([[0, -1], [1, 0]])
    f_o = r * (d.dot(rotMat * v) ) / (v.norm() * v.norm())
    return 1 / f_o

def factors(cfg: TrackingWheelCfg, i):
    x = xfactor(cfg.radius_meters, cfg.theta_rad)
    y = yfactor(cfg.radius_meters, cfg.theta_rad)
    d = Matrix([[cos(cfg.theta_rad)], [sin(cfg.theta_rad)]])
    o = ofactor(cfg.radius_meters, cfg.v, d)
    # return [x, y, o]
    return [1 / symbols(f'f_x{i}'), 1 / symbols(f'f_y{i}'), 1/␣
 ↪symbols(f'f_o{i}')]
```

[ ]:
```
cfg1 = TrackingWheelCfg(Matrix([['v_x1'], ['v_y1']]), symbols('o_1'),␣
 ↪symbols('r_1'))
cfg2 = TrackingWheelCfg(Matrix([['v_x2'], ['v_y2']]), symbols('o_2'),␣
 ↪symbols('r_2'))
cfg3 = TrackingWheelCfg(Matrix([['v_x3'], ['v_y3']]), symbols('o_3'),␣
 ↪symbols('r_3'))
```

```
# cfg1 = TrackingWheelCfg(Matrix([-0.04445, 0.06985]), 0, 0.028297632)
# cfg2 = TrackingWheelCfg(Matrix([0.008382, -0.06985]), pi, 0.028297632)
# cfg3 = TrackingWheelCfg(Matrix([-0.2032, -0.0127]), 3 * pi / 2, 0.028297632)


F1s = factors(cfg1, 1)
F2s = factors(cfg2, 2)
F3s = factors(cfg3, 3)
```

[ ]:
```
Tr = Matrix([F1s, F2s, F3s])
Tr
```

[ ]:
$$\begin{bmatrix} \frac{1}{f_{x1}} & \frac{1}{f_{y1}} & \frac{1}{f_{o1}} \\ \frac{1}{f_{x2}} & \frac{1}{f_{y2}} & \frac{1}{f_{o2}} \\ \frac{1}{f_{x3}} & \frac{1}{f_{y3}} & \frac{1}{f_{o3}} \end{bmatrix}$$

[ ]:
```
Tr.inverse_ADJ()
```

[ ]:
$$\begin{bmatrix} \frac{\frac{1}{f_{o3}f_{y2}} - \frac{1}{f_{o2}f_{y3}}}{-\frac{1}{f_{o3}f_{x2}f_{y1}} + \frac{1}{f_{o3}f_{x1}f_{y2}} + \frac{1}{f_{o2}f_{x3}f_{y1}} - \frac{1}{f_{o2}f_{x1}f_{y3}} - \frac{1}{f_{o1}f_{x3}f_{y2}} + \frac{1}{f_{o1}f_{x2}f_{y3}}} & \frac{-\frac{1}{f_{o3}f_{y1}} + \frac{1}{f_{o1}f_{y3}}}{-\frac{1}{f_{o3}f_{x2}f_{y1}} + \frac{1}{f_{o3}f_{x1}f_{y2}} + \frac{1}{f_{o2}f_{x3}f_{y1}} - \frac{1}{f_{o2}f_{x1}f_{y3}} - \frac{1}{f_{o1}f_{x3}f_{y2}} + \frac{1}{f_{o1}f_{x2}}} \\ \frac{-\frac{1}{f_{o3}f_{x2}} + \frac{1}{f_{o2}f_{x3}}}{-\frac{1}{f_{o3}f_{x2}f_{y1}} + \frac{1}{f_{o3}f_{x1}f_{y2}} + \frac{1}{f_{o2}f_{x3}f_{y1}} - \frac{1}{f_{o2}f_{x1}f_{y3}} - \frac{1}{f_{o1}f_{x3}f_{y2}} + \frac{1}{f_{o1}f_{x2}f_{y3}}} & \frac{\frac{1}{f_{o3}f_{x1}} - \frac{1}{f_{o1}f_{x3}}}{-\frac{1}{f_{o3}f_{x2}f_{y1}} + \frac{1}{f_{o3}f_{x1}f_{y2}} + \frac{1}{f_{o2}f_{x3}f_{y1}} - \frac{1}{f_{o2}f_{x1}f_{y3}} - \frac{1}{f_{o1}f_{x3}f_{y2}} + \frac{1}{f_{o1}f_{x2}}} \\ \frac{-\frac{1}{f_{x3}f_{y2}} + \frac{1}{f_{x2}f_{y3}}}{-\frac{1}{f_{o3}f_{x2}f_{y1}} + \frac{1}{f_{o3}f_{x1}f_{y2}} + \frac{1}{f_{o2}f_{x3}f_{y1}} - \frac{1}{f_{o2}f_{x1}f_{y3}} - \frac{1}{f_{o1}f_{x3}f_{y2}} + \frac{1}{f_{o1}f_{x2}f_{y3}}} & \frac{\frac{1}{f_{x3}f_{y1}} - \frac{1}{f_{x1}f_{y3}}}{-\frac{1}{f_{o3}f_{x2}f_{y1}} + \frac{1}{f_{o3}f_{x1}f_{y2}} + \frac{1}{f_{o2}f_{x3}f_{y1}} - \frac{1}{f_{o2}f_{x1}f_{y3}} - \frac{1}{f_{o1}f_{x3}f_{y2}} + \frac{1}{f_{o1}f_{x2}}} \end{bmatrix}$$