1D Radiative Model

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1 ATSC 409 Project: 1D Radiative Model

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```
import numpy as np
import matplotlib.pyplot as plt
```

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```
# Runge-Kutta 4th order
def rk4(f, x0, y0, x1, n):
    h = (x1 - x0) / n
    x = np.arange(x0, x1, h)
    y = np.zeros((n + 1))
    y[0] = y0
    for i in range(n):
        k1 = h * f(x[i], y[i])
        k2 = h * f(x[i] + h / 2, y[i] + k1 / 2)
        k3 = h * f(x[i] + h / 2, y[i] + k2 / 2)
        k4 = h * f(x[i] + h, y[i] + k3)
        y[i + 1] = y[i] + (k1 + 2 * k2 + 2 * k3 + k4) / 6
    return x, y
```

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```
rk4(lambda x, y: y, 0, 1, 1, 100)
```

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```
(array([0.  , 0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.1 ,
        0.11, 0.12, 0.13, 0.14, 0.15, 0.16, 0.17, 0.18, 0.19, 0.2 , 0.21,
        0.22, 0.23, 0.24, 0.25, 0.26, 0.27, 0.28, 0.29, 0.3 , 0.31, 0.32,
        0.33, 0.34, 0.35, 0.36, 0.37, 0.38, 0.39, 0.4 , 0.41, 0.42, 0.43,
        0.44, 0.45, 0.46, 0.47, 0.48, 0.49, 0.5 , 0.51, 0.52, 0.53, 0.54,
        0.55, 0.56, 0.57, 0.58, 0.59, 0.6 , 0.61, 0.62, 0.63, 0.64, 0.65,
        0.66, 0.67, 0.68, 0.69, 0.7 , 0.71, 0.72, 0.73, 0.74, 0.75, 0.76,
        0.77, 0.78, 0.79, 0.8 , 0.81, 0.82, 0.83, 0.84, 0.85, 0.86, 0.87,
        0.88, 0.89, 0.9 , 0.91, 0.92, 0.93, 0.94, 0.95, 0.96, 0.97, 0.98,
        0.99]),
 array([1.        , 1.01005017, 1.02020134, 1.03045453, 1.04081077,
        1.0512711 , 1.06183655, 1.07250818, 1.08328707, 1.09417428,
        1.10517092, 1.11627807, 1.12749685, 1.13882838, 1.1502738 ,
        1.16183424, 1.17351087, 1.18530485, 1.19721736, 1.2092496 ,
        1.22140276, 1.23367806, 1.24607673, 1.25860001, 1.27124915,
```

```
1.28402542, 1.29693009, 1.30996445, 1.32312981, 1.33642749,
1.34985881, 1.36342511, 1.37712776, 1.39096813, 1.40494759,
1.41906755, 1.43332941, 1.44773461, 1.46228459, 1.47698079,
1.4918247 , 1.50681779, 1.52196156, 1.53725752, 1.55270722,
1.56831219, 1.58407398, 1.59999419, 1.6160744 , 1.63231622,
1.64872127, 1.66529119, 1.68202765, 1.69893231, 1.71600686,
1.73325302, 1.7506725 , 1.76826705, 1.78603843, 1.80398842,
1.8221188 , 1.8404314 , 1.85892804, 1.87761058, 1.89648088,
1.91554083, 1.93479233, 1.95423732, 1.97387773, 1.99371553,
2.01375271, 2.03399126, 2.05443321, 2.07508061, 2.09593551,
2.11700002, 2.13827622, 2.15976625, 2.18147227, 2.20339643,
2.22554093, 2.24790799, 2.27049984, 2.29331874, 2.31636698,
2.33964685, 2.36316069, 2.38691085, 2.41089971, 2.43512965,
2.45960311, 2.48432253, 2.50929039, 2.53450918, 2.55998142,
2.58570966, 2.61169647, 2.63794446, 2.66445624, 2.69123447,
2.71828183]))
```

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