ECE09426 Lecture 6 Homework

Aidan Sharpe

March 3rd, 2025

Required PDMS for a HAW System

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

P_TX = 7E3
LOSS_TX = 10**(5/10)
GAIN_TX = 10**(35/10)
MAX_RANGE = 60E3
TARGET_AREA = 1

def PDMS(tx_power, tx_gain, radar_cross_section, tx_loss, dist_source_target, dist_target_missile):
    tx_p_gain = (tx_power*tx_gain) / (4*np.pi*tx_loss)
    p_ref = radar_cross_section / (dist_source_target**2)
    p_rx = 1 / (4*np.pi*dist_target_missile**2)

    return tx_p_gain * p_ref * p_rx


def main():
    pd_min = PDMS(P_TX, GAIN_TX, TARGET_AREA, LOSS_TX, MAX_RANGE, MAX_RANGE)
    pd_min_db = 10*np.log10(pd_min)
    print(pd_min_db)
```

PDMS required = -144.6592668956451

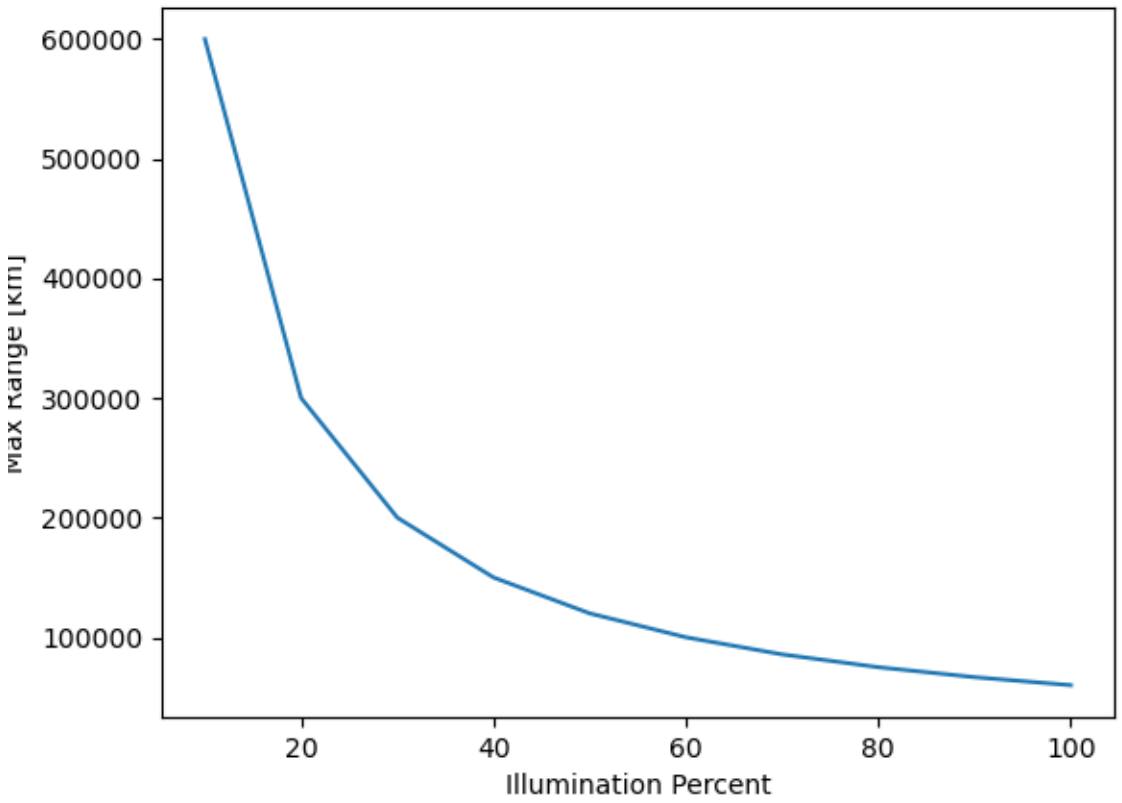
PDMS for a non-HAW System

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

MAX_RANGE = 60E3

def main():
    illumination_percent = np.arange(0.1, 1.1, 0.1)
    max_range = MAX_RANGE/illumination_percent

    plt.plot(100*illumination_percent, max_range)
    plt.xlabel("Illumination Percent")
    plt.ylabel("Max Range [km]")
    plt.show()
```



Rocket Motor Math

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

g = 9.81
I_SP = 250
BURN_TIME = 14
INITIAL_MASS = 1200
FINAL_MASS = 700

def v_burnout(I_sp, t_burn, w_launch, w_burnout):
    return I_sp * g*np.log(w_launch/w_burnout)


def main():
    t = np.linspace(0, BURN_TIME, 500)

    m_propellant = INITIAL_MASS - FINAL_MASS
    w_propellant_0 = g*m_propellant
    w_rocket = g*FINAL_MASS

    weight_flow_rate = w_propellant_0/BURN_TIME
```

```
    v_exit = I_sp*g
    w_propellant = w_propellant_0 - weight_flow_rate*t

    thrust = weight_flow_rate*v_exit*g
    w_total = w_rocket + w_propellant

    acceleration_g = thrust/w_total

    plt.plot(t, acceleration_g)
    plt.show()


if __name__ == "__main__":
    main()
```