Differential Equations

The system of equations representing the interaction between human civilians ($H(t)$), human military forces ($M(t)$), and aliens ($A(t)$) is given by:

$$\frac{dH}{dt} = r_H H - \beta MA - \delta HA - kH$$

$$\frac{dM}{dt} = kH - \beta MA$$

$$\frac{dA}{dt} = r_A A - \alpha MA - \gamma A - C\lambda H$$

Constants and Their Meanings

- $r_H = 0.03$: Human civilian population growth rate. Represents the natural growth of the civilian population.
- $k = 0.02$: Recruitment rate of civilians into the military. Determines how many civilians join the military.
- $r_A = 0.005$: Alien population growth rate. Represents the natural growth of the alien population.
- $\alpha = 0.0005$: Death rate of aliens due to military combat. Determines the effectiveness of military forces against aliens.
- $\beta = 0.005$: Death rate of human military due to aliens. Indicates how lethal aliens are to the military.
- $\gamma = 0.00001$: Death rate of aliens due to environmental adaptation challenges.
- $\lambda = 0.00002$: Death rate of aliens due to non-military human actions. Represents the impact of civilians resisting the aliens.
- $\delta = 0.00001$: Death rate of civilians due to alien actions. Models the lethality of alien attacks on civilians.
- $C = 0.0005$: Probability factor for civilians killing aliens. Adjusts the impact of non-military human resistance on aliens.

Terms in the Equations

- $r_H H$: Natural growth of the civilian population.
- βMA: Losses to civilians and military due to combat with aliens.
- δHA: Civilian losses due to alien attacks.

- kH: Civilians recruited into the military.
- $kH - \beta MA$: Recruitment increases military population, but combat reduces it.
- $r_A A$: Natural growth of the alien population.
- αMA: Alien losses due to military combat.
- γA: Alien losses due to environmental factors.
- $C\lambda H$: Alien losses due to civilian resistance.