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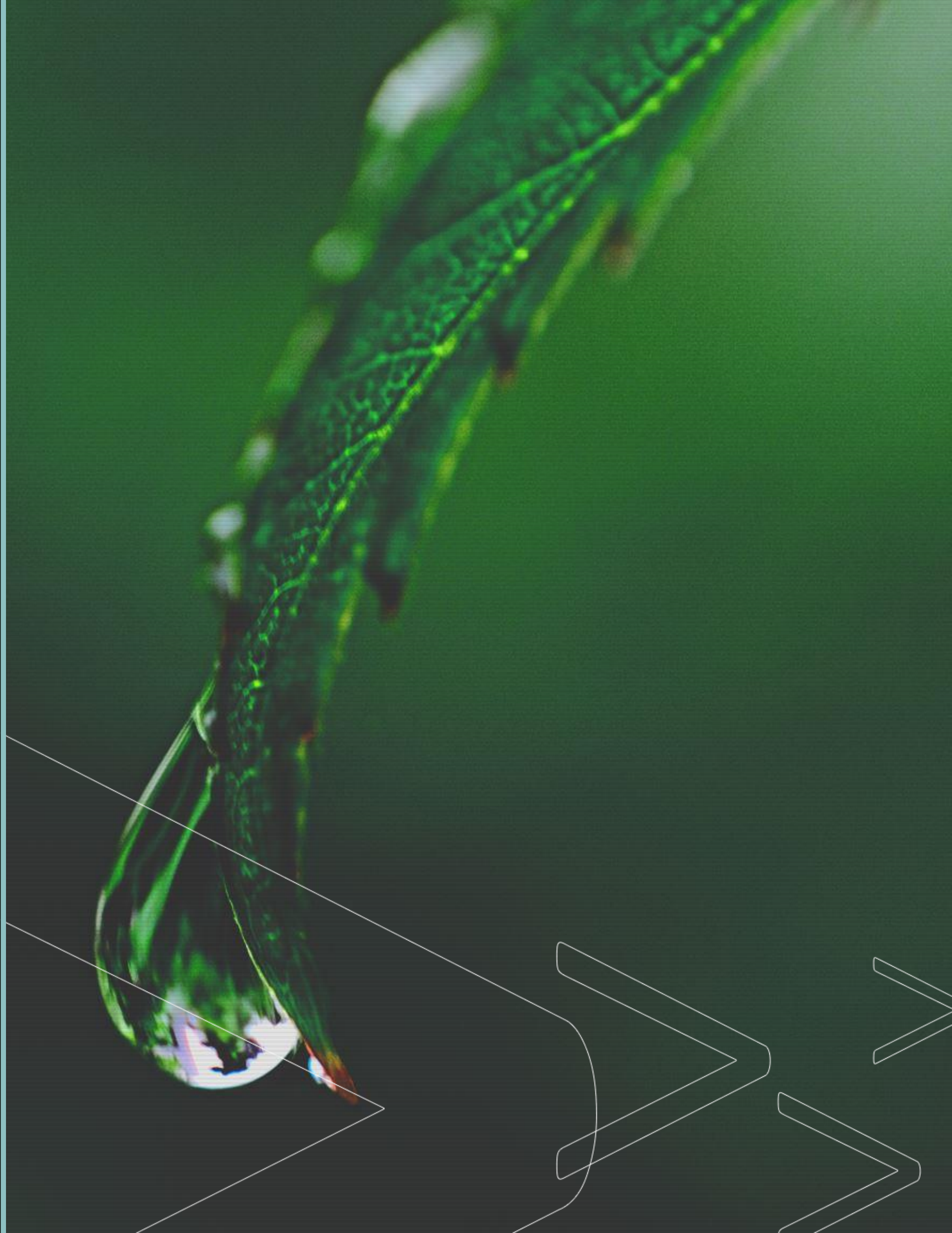
Problem C: Chemical Espionage



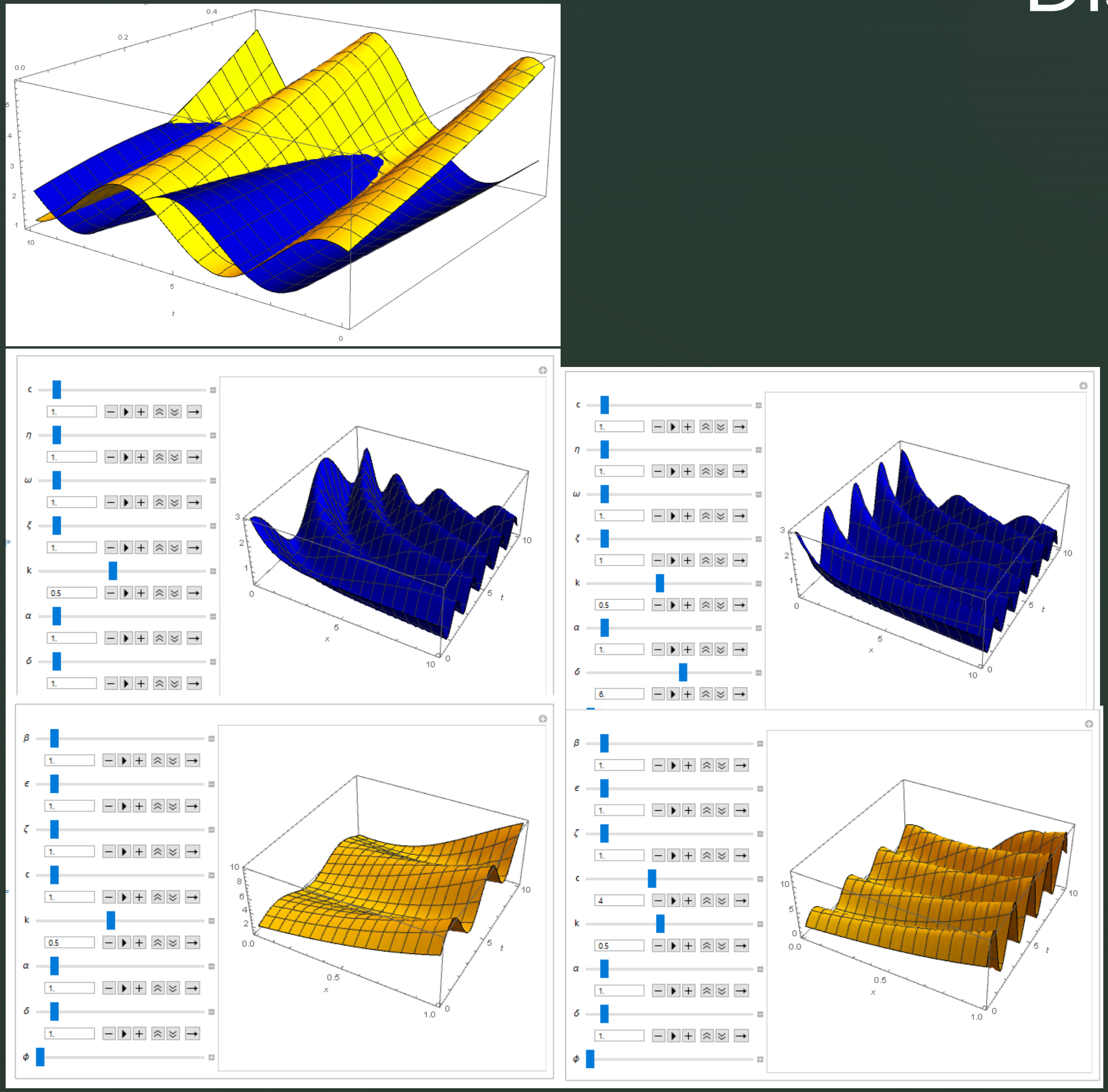
The Model

- $B(x,t) = \frac{c}{\frac{L_2}{1+A_2 e^{-B_2 x}}}\left(1 + Kcos\left(\sqrt{(a_1 x + a_2)c}t + \Phi\right)\right)$

- $W(x,t) = \frac{a_1 x + a_2}{\frac{L_1}{1+A_1 e^{B_1 x}}}\left(1 + \sqrt{\frac{c}{a_1 x + a_2}}Ksin\left(\sqrt{(a_1 x + a_2)c}t + \Phi\right)\right)$

Derivation of the Model

- Original Lotka-Volterra equations:
  - $\frac{dB}{dT} = B(a - bW)$
  - $\frac{dW}{dt} = W(-c + dB)$
- Adaptions:
  - Logistic growth to account for effect of the chemicals in the interaction terms
  - Exponentiation of the butterfly population has a linear growth based on the amount of chemicals



Discussion of Results

- Overlay allows us to see how the two interact with each other
- Hard to determine constants
  - Lack of data and time
- Change values to view differences
- In general, reproductive periods are related.

New Issue – Adding Birds to the Model

- New equations:
  - $\frac{dB}{dt} = B(a - bW - cR)$
  - $\frac{dW}{dt} = W(-d + eB - fR)$
  - $\frac{dR}{dt} = R(-g + hB + mw)$

- Questions?