SIRZ Pandemic Model

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Phy 150

SIR Model

- Used for Modeling Disease Epidemics
- Most Common: Kermack/McKendrick

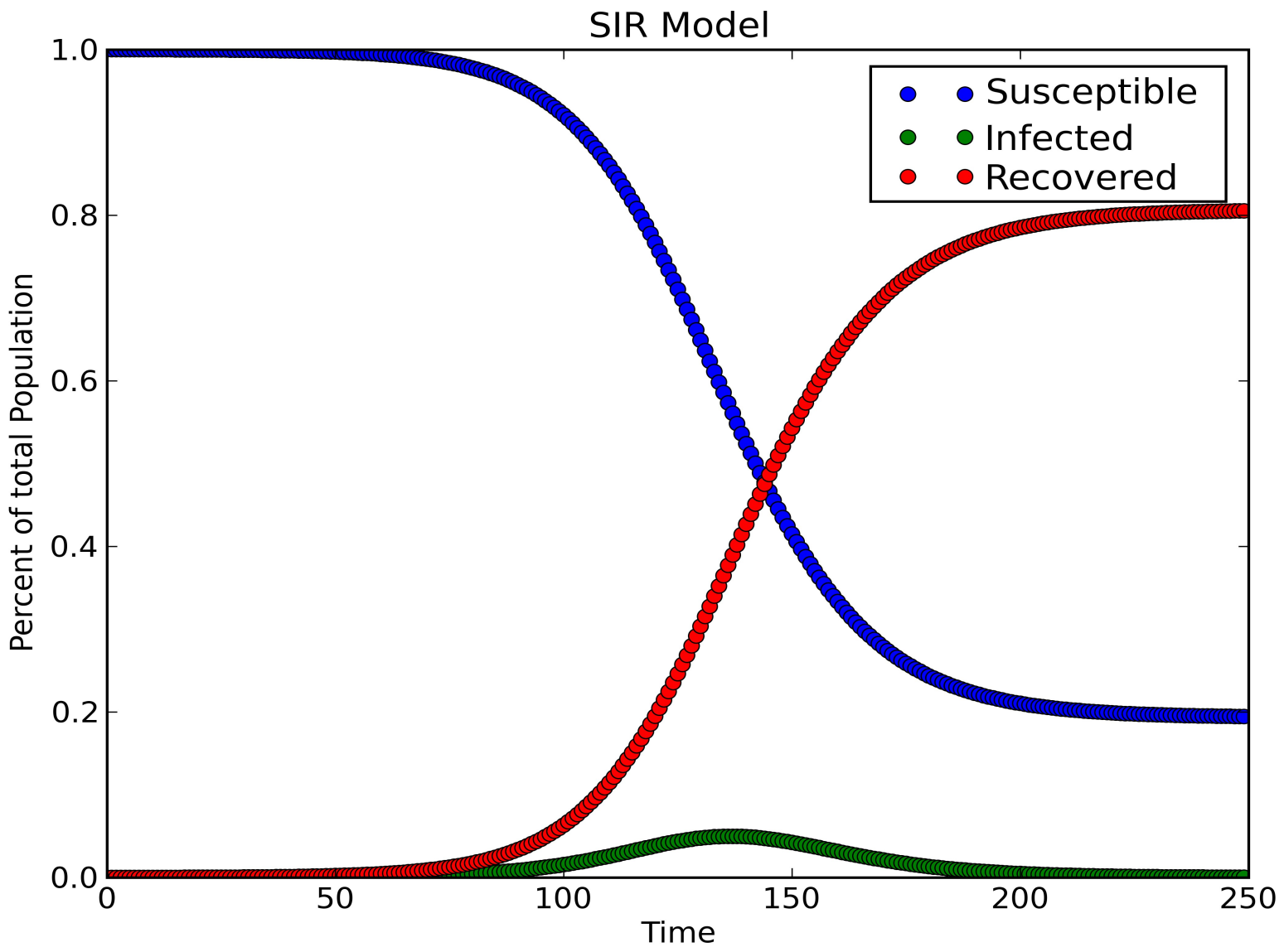
$$\frac{dS}{dt} = -\beta I S$$

$$\frac{dI}{dt} = \beta I S - \nu I$$

$$\frac{dR}{dt} = \nu I$$

S – Susceptible
I – Infected
R – Recovered

B – Infection Rate
v – Recovery Rate



Initial Conditions:

Modified SIR Model

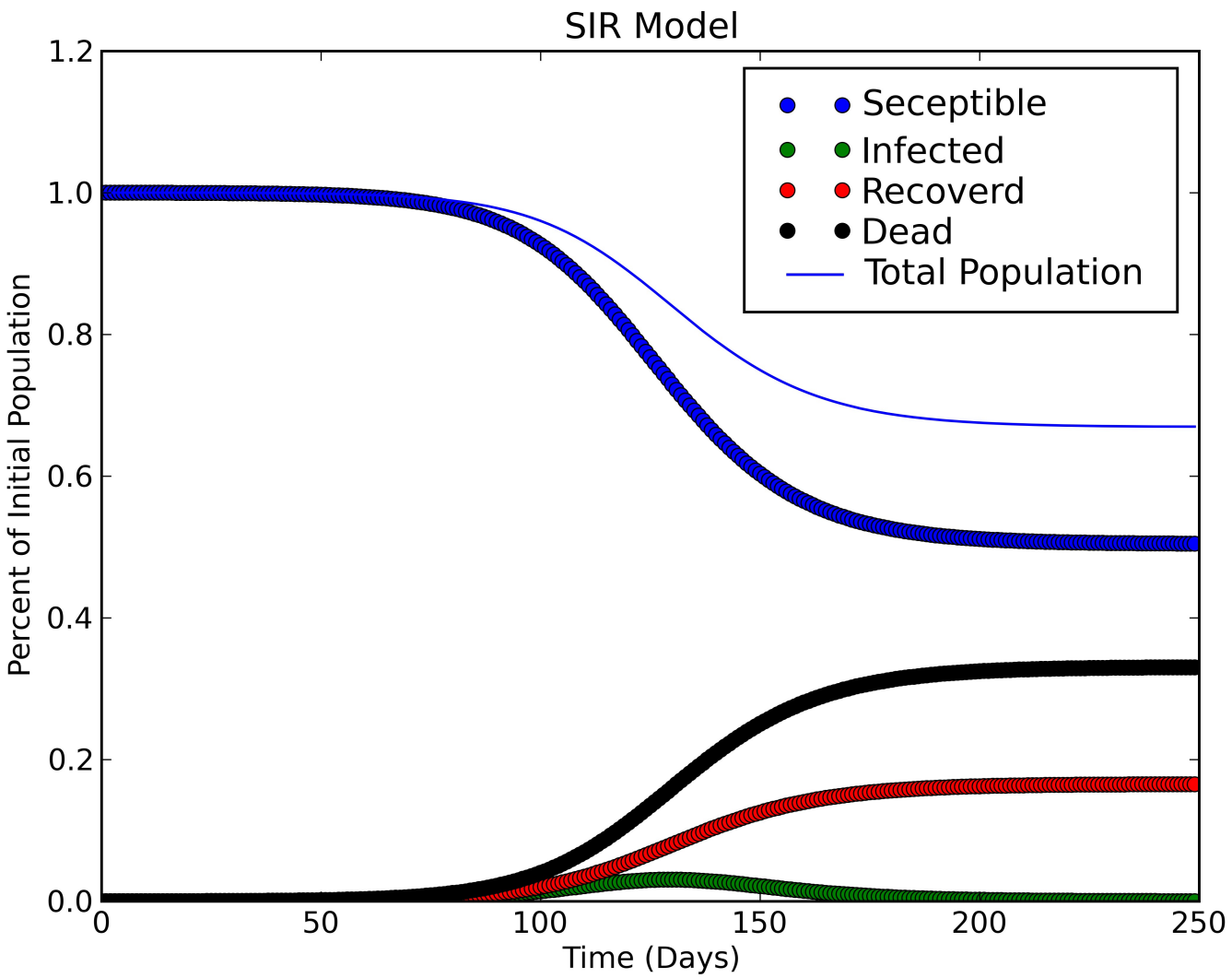
- Includes Fatalities from the Disease
- dP/dt no longer constant

$$\frac{dS}{dt} = -\beta I S$$

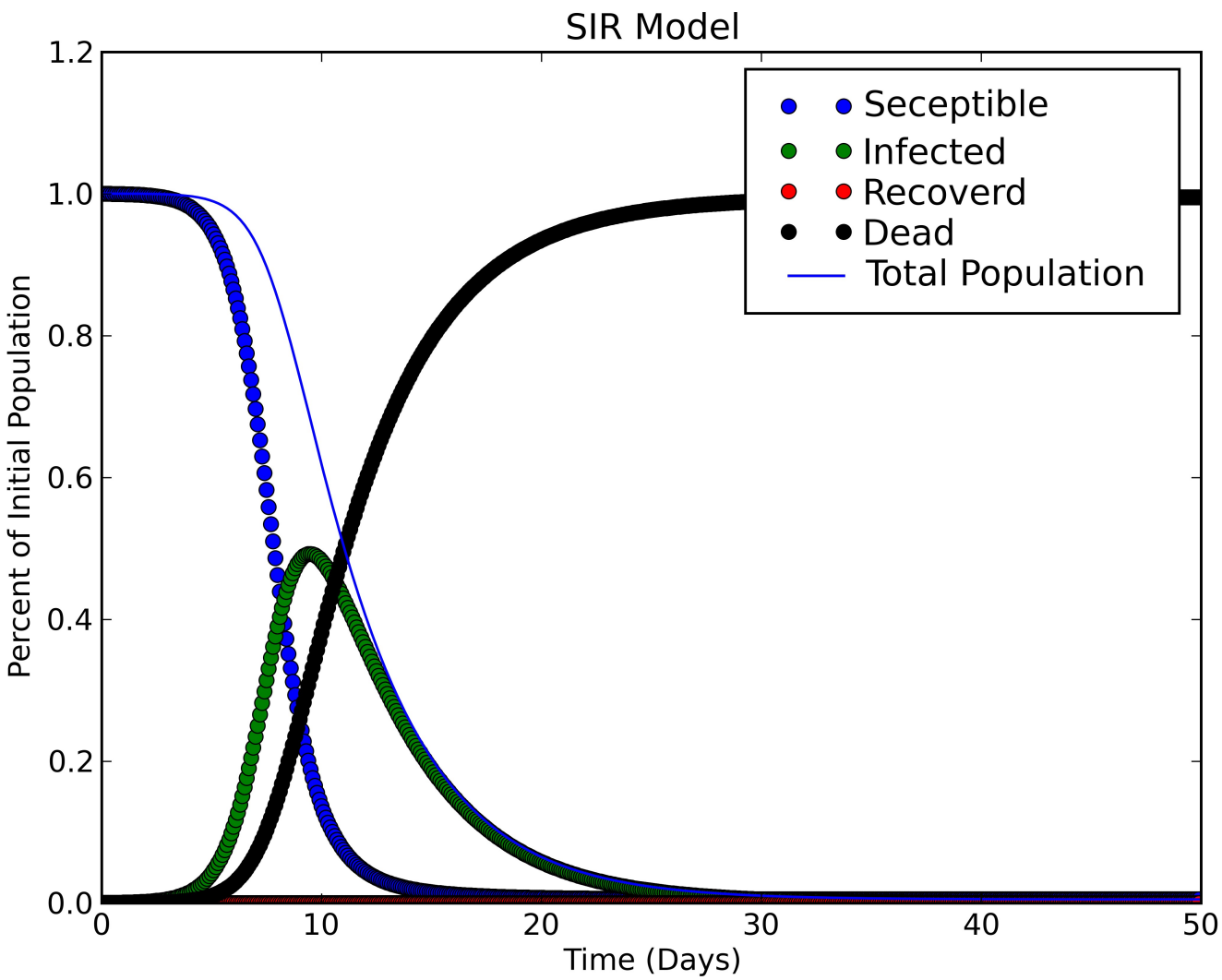
$$\frac{dI}{dt} = \beta I S - I(\alpha + \nu)$$

$$\frac{dR}{dt} = \nu I$$

New Variable
alpha: Death Rate



Initial Conditions: B=0.5, v=0.083, a=0.166



Initial Conditions: B=2.0, v=0.0 a=2.5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MADDRAX
DIE DUNKLE ZUKUNFT DER ERDE
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SIRZ Model

- Zombies kill Suceptible and Recovered Humans evenly

$$\frac{dS}{dt} = -\beta IS - \Phi(\frac{S}{R+S})Z$$

$$\frac{dI}{dt} = \beta IS - I(\alpha + \nu)$$

$$\frac{dR}{dt} = \nu I - \Phi(\frac{R}{R+S})Z$$

$$\frac{dZ}{dt} = \alpha I - (\phi_1 Z)(1-\phi_2)$$

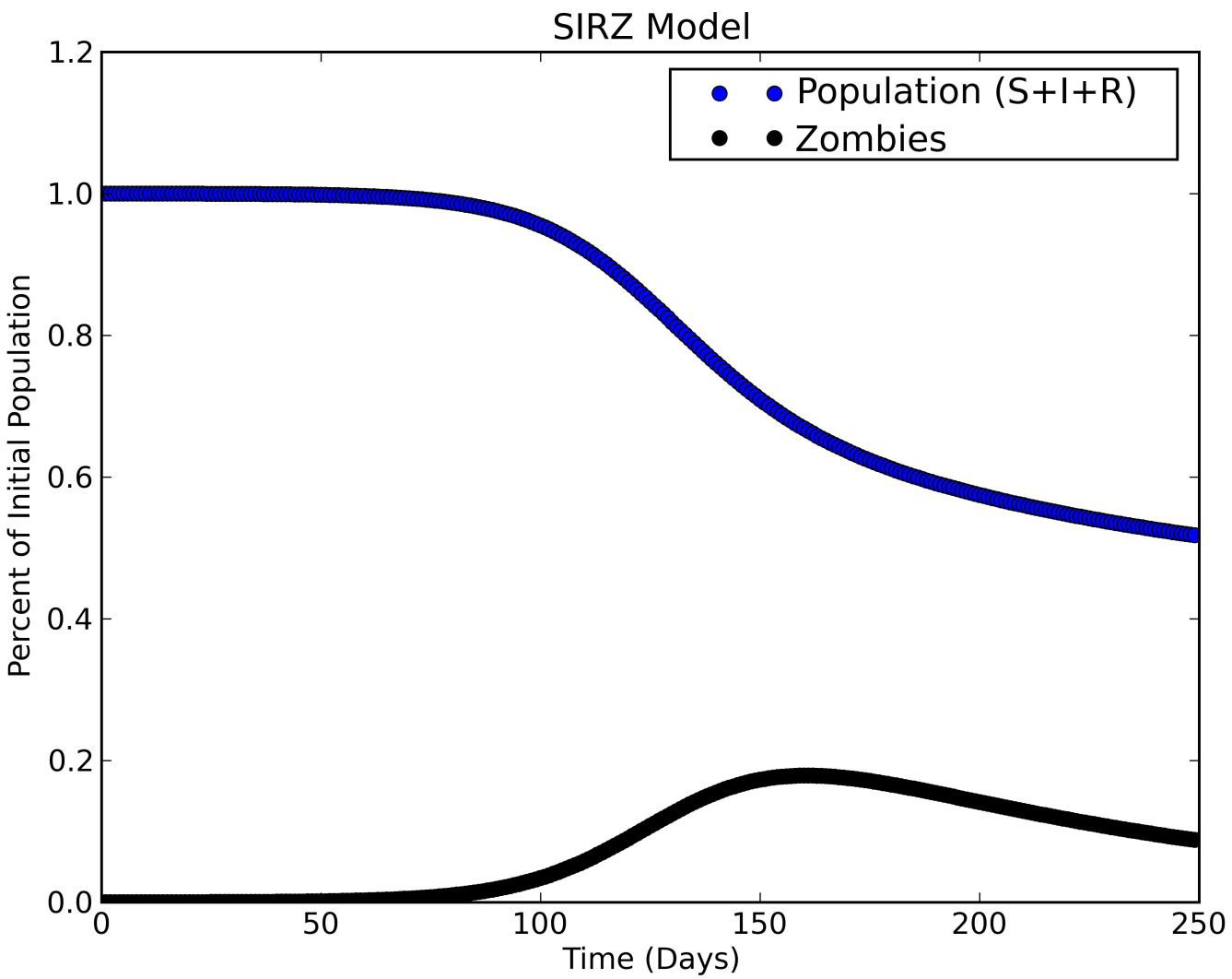
Z – Zombies

Phi{1} – encounter frequency
Phi{2} – zombie strength

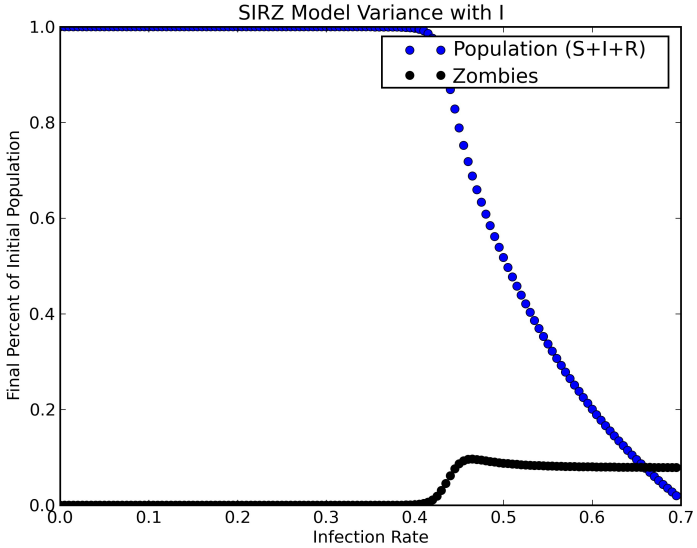
$\Phi = \phi_1\phi_2$

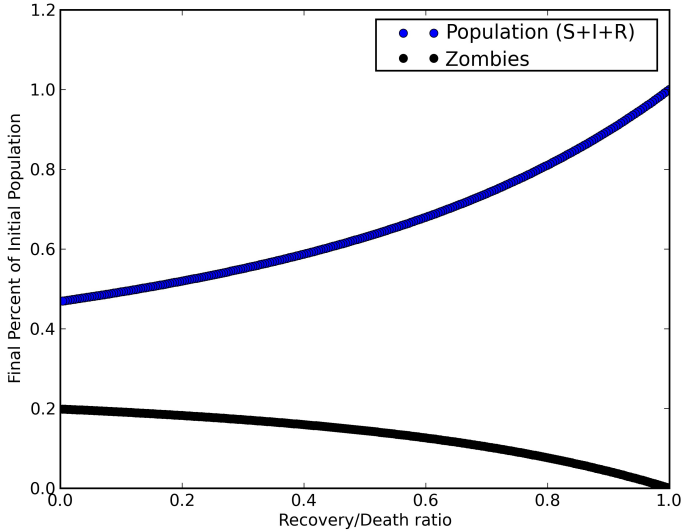
Sum Parameter

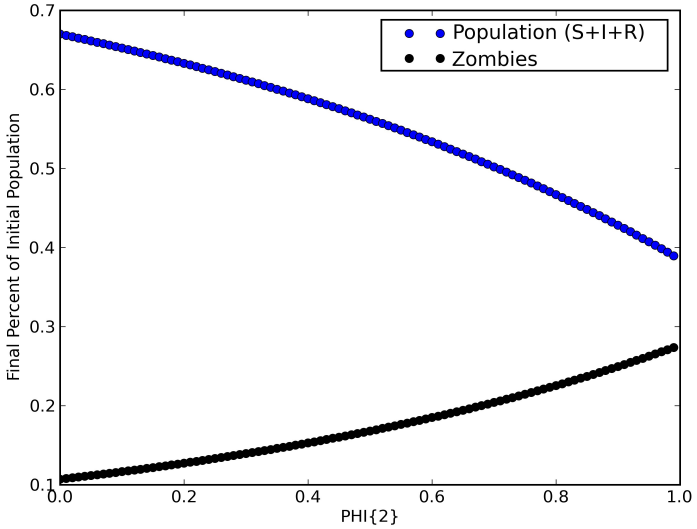
$$P = S + I + R$$

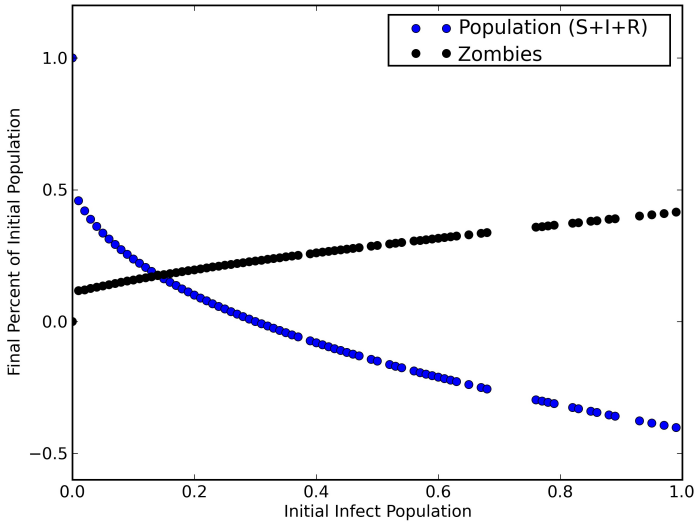


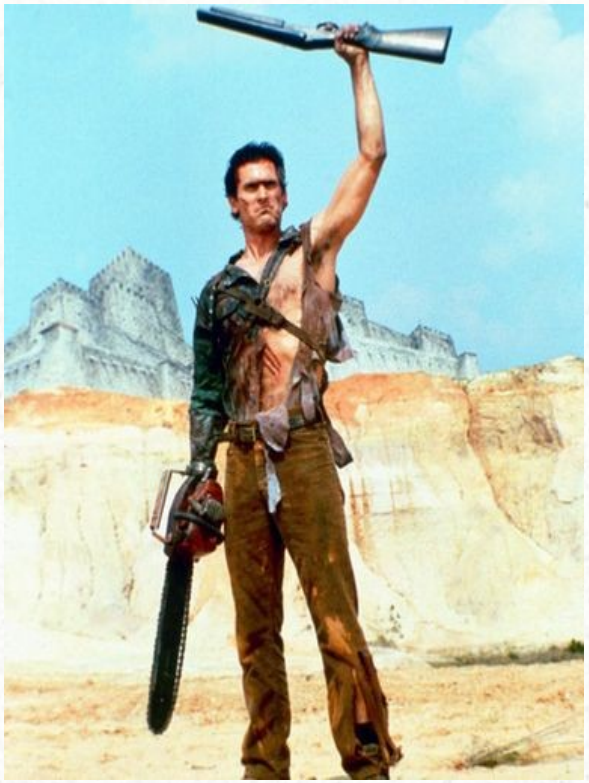
Initial Conditions: B=0.5, v=0.083, a=0.166, ϕ_1=0.01, ϕ_2=0.5


SIRZ Model Variance with I
Population (S+I+R)
Zombies
Final Percent of Initial Population
Infection Rate
0.0
0.2
0.4
0.6
0.8
1.0
0.1
0.3
0.5
0.7


Population (S+I+R)
Zombies
Final Percent of Initial Population
Recovery/Death ratio
0.0
0.2
0.4
0.6
0.8
1.0
1.2


Population (S+I+R)
Zombies
Final Percent of Initial Population
PHI{2}
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.0
0.2
0.4
0.6
0.8
1.0


Population (S+I+R)
Zombies
Final Percent of Initial Population
Initial Infect Population
−0.5
0.0
0.5
1.0
0.0
0.2
0.4
0.6
0.8
1.0



CONCLUSION: WE ARE SAFE