

$$(1) \quad \frac{dS}{dt} = -\frac{S(t)}{N}Z - \beta \frac{S(t)I(t)}{N} + VIi + VLe - \frac{VIi + VLe}{N}S(t) - \frac{R(t) - \gamma I(t) - \epsilon S(t)}{\mu d}u(t - t_v)$$