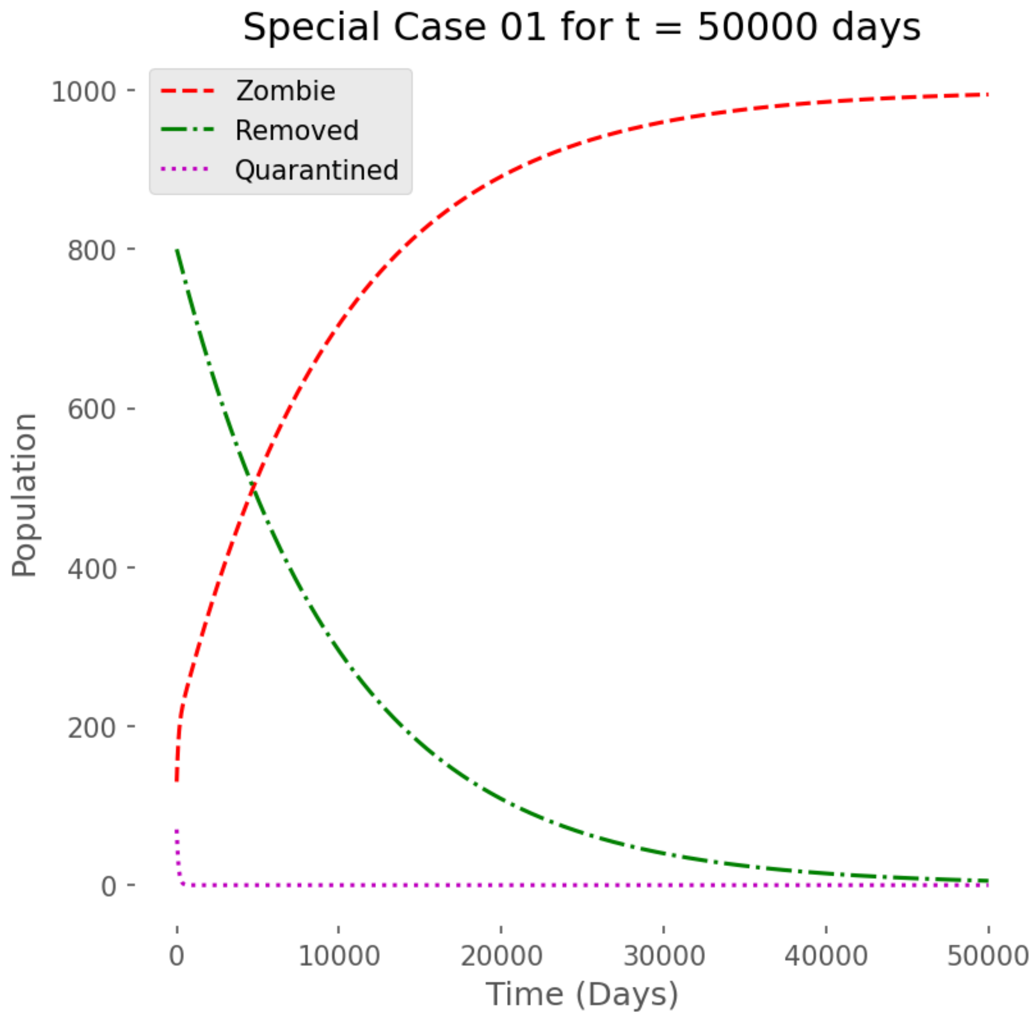
ModifiedSEZQR_SpecialCase

September 28, 2021

[8]:
```
#!/usr/bin/env python
# -*- coding: utf-8 -*-

"""This simple program tries to solve the ODE of the Modified SEZQR model-␣
↪Special Case 01 with perturbation
    and create a numerical solution.
    After that, this program draws the solution graph for the Zombie,␣
↪Quarantined and Removed
    Population. This simple graph helps us to understand the actual scenario of␣
↪the population
    from the modified SEZQR model- Special Case 01 after a certain number of␣
↪days.

   Part of MS Thesis at Universität Koblenz-Landau
   Note: this program uses the following libraries-  Numpy, Matplotlib, Scipy
   Python Version 3.7
"""

# MODIFIED SEZQR MODEL- SPECIAL CASE 01

# importing libraries
import numpy as np
from scipy.integrate import solve_ivp
import matplotlib.pyplot as plt
from matplotlib.pyplot import figure
figure(figsize=(6, 6), dpi=150)

# I'm using this style for a pretier plot, but it's not actually necessary
plt.style.use('ggplot')

# Parameter values
beta = 0.0095
alpha = 0.005
zeta = 0.0001
rho = 0.005
kappa = 0.001
sigma = 0.001
```

```
gamma = 0.0001
kappa = 0.0001
omega = 0.009
N = 1000  # initial population

# Perturbation Parameter Mu, change this value to see different results
mu = 0.175

# Defining Function of the SEZQR ODE
def model(t, x):
    Z = x[0] # zombies
    Q = x[1] # quarentined
    dzdt = zeta*(N - Z - Q) + omega*Q # Zombies
    dqdt = - gamma*Q - omega*Q # Quarantined
    dxdt = [dzdt, dqdt]
    return dxdt

# Initial Condition. Zombie= 130, Quarantined = 70
x0 = [130, 70]

# Time, as in number of days. Total days= 1000
t = np.array([0, 50000])
tspan = np.linspace(t[0], t[1], 50000)

# Calculating numerical solution of the given ODEs
x = solve_ivp(model, t, x0, t_eval=tspan)

time = x.t
zombie = x.y[0]
quarantined  = x.y[1]
removed = (N - zombie - quarantined)

# Plot
plt.plot(time, zombie, 'r--', label="Zombie") # Zombie Population Graph
plt.plot(time, removed, 'g-.', label="Removed") # Recovered Population Graph
plt.plot(time, quarantined , 'm:', label="Quarantined")
plt.title('Special Case 01 for t = 50000 days')
plt.ylabel('Population')
plt.xlabel('Time (Days)')
plt.legend(loc='best')
ax = plt.gca()
ax.set_facecolor('w')
plt.show()

__author__ = "Md Tariqul Islam"
__version__ = "1.0"
__maintainer__ = "Tariqul"
```

```python
__email__ = "tariquldipu@uni-koblenz.de"
__status__ = "Final"
```



[ ]:

```

```