This file contains copied code from base_sir_fit

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Although it has copied code, the inputs are different to accomidate for

new state varibles that we eventually add to our model

The files that are called in this file are siroutput_part3_before.m,

siroutput_part3_after.m, and siroutput_full_part3_after.m

Before Vaccinations

```
mockData = cat(2, newInfections', cumulativeDeaths');
mockData_before_vaccine=mockData(1:100,:);
mockData_after_vaccine=mockData(100:365,:);
t = 100;
```

The line of code above represents the base phase of the simulation

before vaccines were introduced into the population

```
sirafun= @(x)siroutput_part3_before(x,t,mockData_before_vaccine);

A = [0,1,1,0,0,0,0];
b = 1;

% Had these parameter to keep the fatality and recovered constants to not
% be greater than 1

Af = [0,0,0,1,1,1,1];
bf = 1;

% Made sure parameters always added up to 1

ub = [1,1,1,1,1,1,1]';
lb = [0,0,0,0,0,0,0]';

% Set bounds so that no fraction ever exeeds 1 or falls below 0

x0Mock_before = [0.2,0.3,0.1,1,0,0,0];


xMock_before = fmincon(sirafun,x0Mock_before,A,b,Af,bf,lb,ub);

Y_fitMock_before = siroutput_full(xMock_before,t);

% This is the outcome of the 1st phase of the simulation


Local minimum possible. Constraints satisfied.

fmincon stopped because the size of the current step is less than
the value of the step size tolerance and constraints are
satisfied to within the value of the constraint tolerance.
```

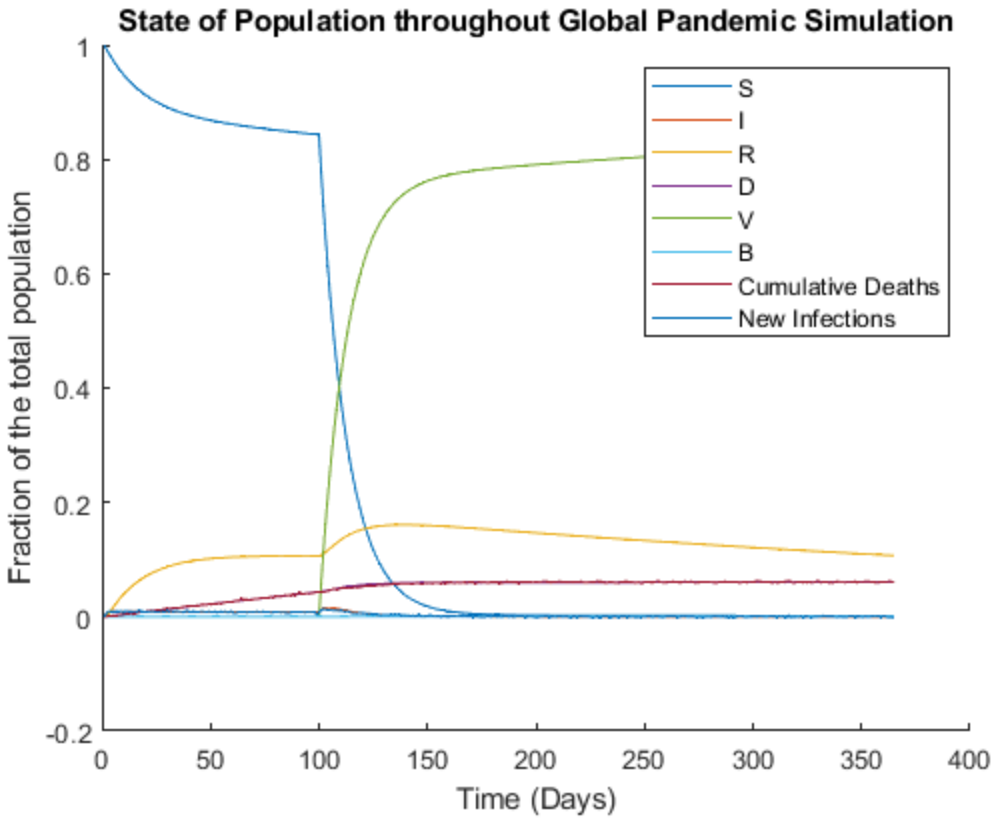
After Vaccinations

```
t = 266;
sirafun= @(x)siroutput_part3_after(x,t,mockData_after_vaccine,
[Y_fitMock_before(100,:),0,0]);

% Had around the same bounds as before but we made sure to have the recover
% and fatality added to not exeed 1 or not have infected and vaccinated
```

```
% together not go past 1 now.

A = [0,1,1,0,0;
     1,0,0,1,0];
b = [1,1];


Af = [];
bf = [];



ub = [1,1,1,1,1]';
lb = [0,0,0,0,0]';
x0Mock_after = [xMock_before(1:3),0.1,0];

% Here we only give it 5 x inputs which will changes the constants of the
% model and not mess with the initial parameters since it kept drastically
% changing them.


xMock_after = fmincon(sirafun,x0Mock_after,A,b,Af,bf,lb,ub);

Y_fitMock_after = siroutput_full_part3_after(xMock_after,t,
[Y_fitMock_before(100,:),0,0]);


Local minimum possible. Constraints satisfied.

fmincon stopped because the size of the current step is less than
the value of the step size tolerance and constraints are
satisfied to within the value of the constraint tolerance.
```

Combined Data

```
% Now the data get combined and placed into one graph to see how it works
% as a whole system

Y_fitMock_before=cat(2,Y_fitMock_before,zeros(100,2));
Y_fitMock_combined=cat(1,Y_fitMock_before(1:99,:),Y_fitMock_after);
figure;
hold on;
title("State of Population throughout Global Pandemic Simulation")
xlabel("Time (Days)")
ylabel("Fraction of the total population")
plot(Y_fitMock_combined);
plot(cumulativeDeaths');
plot(newInfections');
legend('S','I','R','D','V','B','Cumulative Deaths', 'New Infections');
```



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