```
                                          Norm of      First-order↙
Trust-region
 Iteration  Func-count     f(x)          step         optimality↙
radius
     0          4       0.0692469                         0.311↙
1
     1          8     9.39926e-05       0.246324         0.0186↙
1
     2         12     2.87333e-10     0.00826242        3.42e-05↙
1
     3         16     5.22684e-21    1.40113e-05        1.56e-10↙
1

Equation solved.

fsolve completed because the vector of function values is near zero
as measured by the value of the function tolerance, and
the problem appears regular as measured by the gradient.

<stopping criteria details>
Max. abs. error in calibration targets:6.3678e-11


pis1 =

   7.8408e-08


pis2 =

   1.2442e-04


pis3 =

    0.3902


RnotSIR =

    1.5035

                                          First-order      Norm of
```

Iter	F-count	f(x)	Feasibility	optimality	step
0	251	-8.282571e+03	0.000e+00	2.954e-01	
1	502	-8.284046e+03	0.000e+00	9.516e-02	1.409e+00
2	753	-8.284525e+03	0.000e+00	5.908e-02	9.613e-01
3	1004	-8.284705e+03	0.000e+00	1.199e-02	7.889e-01
4	1255	-8.284740e+03	0.000e+00	5.701e-03	4.314e-01
5	1506	-8.284743e+03	0.000e+00	3.841e-03	1.204e-01
6	1757	-8.284744e+03	0.000e+00	4.073e-03	3.289e-02
7	2008	-8.284744e+03	0.000e+00	4.449e-03	1.911e-02

Solver stopped prematurely.

fmincon stopped because it exceeded the function evaluation limit,
options.MaxFunctionEvaluations = 2.000000e+03.

Iteration	Func-count	f(x)	Norm of step	First-order optimality	Trust-region radius
0	751	6.63378e+06		2.4e+04	1
1	1502	6.34233e+06	1	2.26e+04	1
2	2253	5.69199e+06	2.5	1.92e+04	2.5
3	3004	4.51597e+06	6.25	1.04e+04	6.25
4	3755	2.86015e+06	15.625	1.38e+04	15.6
5	4506	188311	39.0625	7.31e+03	39.1
6	5257	46.0222	13.7397	155	97.7
7	6008	1.13725e-05	0.139921	0.0973	97.7
8	6759	6.19153e-19	0.00011403	2.98e-08	97.7
9	7510	1.8156e-23	9.64912e-09	1.01e-10	97.7

Equation solved.

fsolve completed because the vector of function values is near zero

```
as measured by the value of the function tolerance, and
the problem appears regular as measured by the gradient.

<stopping criteria details>
Max. abs. error in equilib. equations:6.8212e-13


RnotSIRmacro =

    1.4374

MATLAB has experienced a low-level graphics error, and may not have↙
drawn correctly.
Read about what you can do to prevent this issue at Resolving Low-↙
Level Graphics Issues then restart MATLAB.
To share details of this issue with MathWorks technical support,
please include this file with your service request.
Error using alternatePrintPath
Java exception occurred:
com.mathworks.hg.util.OutputHelperProcessingException: Problem while↙
processing in an
OutputHelper. Error making context 0xd0000 current on Thread AWT-↙
EventQueue-0,
drawableWrite 0x2a01108c, drawableRead 0x2a01108c, werr: 0,↙
WindowsWGLContext
[Version 4.4 (Compat profile, arb, compat[ES2, ES3], FBO, hardware) -↙
4.4.0 - Build
20.19.15.4835 [GL 4.4.0, vendor 20.19.15 (- Build 20.19.15.4835)],↙
options 0x2c03,
this 0x1adf2f6f, handle 0xd0000, isShared false,
jogamp.opengl.gl4.GL4bcImpl@672bb55c,
     quirks: [NoDoubleBufferedBitmap, NoSurfacelessCtx],
    Drawable: ResizeableImpl[Initialized true, realized true, texUnit↙
0, samples 8,
    Factory   jogamp.opengl.windows.wgl.↙
WindowsWGLDrawableFactory@31488f77,
    Handle    0x2a01108c,
    Caps      GLCaps[wgl vid 7 arb: rgba 8/8/8/8, opaque, accum-rgba↙
0/0/0/0,
    dp/st/ms 16/0/8, sample-ext default, dbl, mono  , hw, GLProfile↙
[GL4bc/GL4bc.hw],
    offscr[fbo]],
    fboI back 0, front 0, num 1,
    FBO front read 2, FBO[name r/w 2/2, init true, bound true, size↙
```

```
700x525, samples
    0/8, modified false/false, depth RenderAttachment[type DEPTH,↙
format 0x81a5,
    samples 0, 700x525, name 0x4, obj 0x24083b9f], stencil null,↙
colorbuffer
    attachments: 1/8, with 0 textures: [ColorAttachment[type COLOR,↙
format 0x8058,
    samples 0, 700x525, name 0x3, obj 0x78b26ddc], null, null, null,↙
null, null,
    null, null], msaa[null, hasSink false, dirty true], state OK, obj↙
0x47cfcc26],
    FBO back  write 1, FBO[name r/w 1/2, init true, bound false, size↙
700x525,
    samples 8/8, modified false/false, depth RenderAttachment[type↙
DEPTH, format
    0x81a5, samples 8, 700x525, name 0x2, obj 0x16434e29], stencil↙
null, colorbuffer
    attachments: 1/8, with 0 textures: [ColorAttachment[type COLOR,↙
format 0x8058,
    samples 8, 700x525, name 0x1, obj 0x7d7410d6], null, null, null,↙
null, null,
    null, null], msaa[ColorAttachment[type COLOR, format 0x8058,↙
samples 0, 700x525,
    name 0x3, obj 0x78b26ddc], hasSink true, dirty false], state OK,↙
obj 0x73f24bbd],
    Surface   GDISurface[ displayHandle 0x0
, surfaceHandle 0x2a01108c
, size 700x525
, UOB[ OWNS_SURFACE | OWNS_DEVICE | WINDOW_INVISIBLE ]
, WindowsWGLGraphicsConfiguration[DefaultGraphicsScreen↙
[WindowsGraphicsDevice[type
.windows, connection decon, unitID 0, handle 0x0, owner false,↙
NullToolkitLock[obj
0x4aef5511]], idx 0], pfdID 7, ARB-Choosen true,
    requested GLCaps[rgba 8/8/8/1, opaque, accum-rgba 0/0/0/0,↙
dp/st/ms 16/0/8,
    sample-ext default, one, mono  , hw, GLProfile[GL4bc/GL4bc.hw],↙
on-scr[.]],
    chosen    GLCaps[wgl vid 7 arb: rgba 8/8/8/8, opaque, accum-rgba↙
0/0/0/0,
    dp/st/ms 16/0/8, sample-ext default, dbl, mono  , hw, GLProfile↙
[GL4bc/GL4bc.hw],
    offscr[fbo]]]
, surfaceLock <4a650719, 174a4c23>[count 1, qsz 0, owner <AWT-↙
```

```
EventQueue-0>]
, GDIDummyUpstreamSurfaceHook[pixel 700x525]
, upstreamSurface false ]]]

    at
    com.mathworks.hg.util.HGGetframeOutputHelper.generateOutput↙
(HGGetframeOutputHelper.java:154)

    at com.mathworks.hg.util.OutputHelper.generateOutput(OutputHelper.↙
java:76)

    at com.mathworks.hg.util.ImageGrabber.generateOutput(ImageGrabber.↙
java:63)

    at com.mathworks.hg.util.ImageGrabber.grab(ImageGrabber.java:32)

    at
    com.mathworks.hg.util.BufferedImageGrabber.captureImage↙
(BufferedImageGrabber.java:48)

    at
    com.mathworks.hg.peer.FigureClientProxyPanel.setPaintDisabled↙
(FigureClientProxyPanel.java:66)

    at com.mathworks.hg.peer.PaintDisabled.setPaintDisabled↙
(PaintDisabled.java:60)

    at
    com.mathworks.hg.peer.↙
HeavyweightLightweightContainerFactory$FigurePanelContainerLight.↙
disablePaint(HeavyweightLightweightContainerFactory.java:326)

    at
    com.mathworks.hg.peer.↙
HeavyweightLightweightContainerFactory$FigurePanelContainerLight.↙
doSetPaintDisabled(HeavyweightLightweightContainerFactory.java:363)

    at
    com.mathworks.hg.peer.↙
HeavyweightLightweightContainerFactory$FigurePanelContainerLight.↙
setPaintDisabled(HeavyweightLightweightContainerFactory.java:387)

    at sun.reflect.NativeMethodAccessorImpl.invoke0(Native Method)
```

```
    at sun.reflect.NativeMethodAccessorImpl.invoke↙
(NativeMethodAccessorImpl.java:62)

    at
    sun.reflect.DelegatingMethodAccessorImpl.invoke↙
(DelegatingMethodAccessorImpl.java:43)

    at java.lang.reflect.Method.invoke(Method.java:498)

    at com.mathworks.jmi.AWTUtilities$Invoker$3$1.call(AWTUtilities.↙
java:525)

    at
    com.mathworks.mvm.context.ThreadContext.callWithContext↙
(ThreadContext.java:105)

    at com.mathworks.mvm.context.MvmContext.callWithContext↙
(MvmContext.java:113)

    at com.mathworks.jmi.AWTUtilities$Invoker$3.runWithOutput↙
(AWTUtilities.java:522)

    at com.mathworks.jmi.AWTUtilities$Invoker$2.watchedRun↙
(AWTUtilities.java:475)

    at com.mathworks.jmi.AWTUtilities$WatchedRunnable.run↙
(AWTUtilities.java:436)

    at java.awt.event.InvocationEvent.dispatch(InvocationEvent.java:↙
311)

    at java.awt.EventQueue.dispatchEventImpl(EventQueue.java:758)

    at java.awt.EventQueue.access$500(EventQueue.java:97)

    at java.awt.EventQueue$3.run(EventQueue.java:709)

    at java.awt.EventQueue$3.run(EventQueue.java:703)

    at java.security.AccessController.doPrivileged(Native Method)

    at
    java.security.ProtectionDomain$JavaSecurityAccessImpl.↙
doIntersectionPrivilege(ProtectionDomain.java:74)
```

```
    at java.awt.EventQueue.dispatchEvent(EventQueue.java:728)

    at
    java.awt.EventDispatchThread.pumpOneEventForFilters↙
(EventDispatchThread.java:205)

    at java.awt.EventDispatchThread.pumpEventsForFilter↙
(EventDispatchThread.java:116)

    at
    java.awt.EventDispatchThread.pumpEventsForHierarchy↙
(EventDispatchThread.java:105)

    at java.awt.EventDispatchThread.pumpEvents(EventDispatchThread.↙
java:101)

    at java.awt.EventDispatchThread.pumpEvents(EventDispatchThread.↙
java:93)

    at java.awt.EventDispatchThread.run(EventDispatchThread.java:82)

Caused by: com.jogamp.opengl.GLException: Error making context 0xd0000↙
current on
Thread AWT-EventQueue-0, drawableWrite 0x2a01108c, drawableRead↙
0x2a01108c, werr: 0,
WindowsWGLContext [Version 4.4 (Compat profile, arb, compat[ES2, ES3],↙
FBO, hardware)
- 4.4.0 - Build 20.19.15.4835 [GL 4.4.0, vendor 20.19.15 (- Build↙
20.19.15.4835)],
options 0x2c03, this 0x1adf2f6f, handle 0xd0000, isShared false,
jogamp.opengl.gl4.GL4bcImpl@672bb55c,
     quirks: [NoDoubleBufferedBitmap, NoSurfacelessCtx],
    Drawable: ResizeableImpl[Initialized true, realized true, texUnit↙
0, samples 8,
    Factory   jogamp.opengl.windows.wgl.↙
WindowsWGLDrawableFactory@31488f77,
    Handle    0x2a01108c,
    Caps      GLCaps[wgl vid 7 arb: rgba 8/8/8/8, opaque, accum-rgba↙
0/0/0/0,
    dp/st/ms 16/0/8, sample-ext default, dbl, mono  , hw, GLProfile↙
[GL4bc/GL4bc.hw],
    offscr[fbo]],
    fboI back 0, front 0, num 1,
```

```
    FBO front read 2, FBO[name r/w 2/2, init true, bound true, size↙
700x525, samples
    0/8, modified false/false, depth RenderAttachment[type DEPTH,↙
format 0x81a5,
    samples 0, 700x525, name 0x4, obj 0x24083b9f], stencil null,↙
colorbuffer
    attachments: 1/8, with 0 textures: [ColorAttachment[type COLOR,↙
format 0x8058,
    samples 0, 700x525, name 0x3, obj 0x78b26ddc], null, null, null,↙
null, null,
    null, null], msaa[null, hasSink false, dirty true], state OK, obj↙
0x47cfcc26],
    FBO back  write 1, FBO[name r/w 1/2, init true, bound false, size↙
700x525,
    samples 8/8, modified false/false, depth RenderAttachment[type↙
DEPTH, format
    0x81a5, samples 8, 700x525, name 0x2, obj 0x16434e29], stencil↙
null, colorbuffer
    attachments: 1/8, with 0 textures: [ColorAttachment[type COLOR,↙
format 0x8058,
    samples 8, 700x525, name 0x1, obj 0x7d7410d6], null, null, null,↙
null, null,
    null, null], msaa[ColorAttachment[type COLOR, format 0x8058,↙
samples 0, 700x525,
    name 0x3, obj 0x78b26ddc], hasSink true, dirty false], state OK,↙
obj 0x73f24bbd],
    Surface   GDISurface[ displayHandle 0x0
, surfaceHandle 0x2a01108c
, size 700x525
, UOB[ OWNS_SURFACE | OWNS_DEVICE | WINDOW_INVISIBLE ]
, WindowsWGLGraphicsConfiguration[DefaultGraphicsScreen↙
[WindowsGraphicsDevice[type
.windows, connection decon, unitID 0, handle 0x0, owner false,↙
NullToolkitLock[obj
0x4aef5511]], idx 0], pfdID 7, ARB-Choosen true,
    requested GLCaps[rgba 8/8/8/1, opaque, accum-rgba 0/0/0/0,↙
dp/st/ms 16/0/8,
    sample-ext default, one, mono  , hw, GLProfile[GL4bc/GL4bc.hw],↙
on-scr[.]],
    chosen    GLCaps[wgl vid 7 arb: rgba 8/8/8/8, opaque, accum-rgba↙
0/0/0/0,
    dp/st/ms 16/0/8, sample-ext default, dbl, mono  , hw, GLProfile↙
[GL4bc/GL4bc.hw],
    offscr[fbo]]]
```

```
, surfaceLock <4a650719, 174a4c23>[count 1, qsz 0, owner <AWT-↙
EventQueue-0>]
, GDIDummyUpstreamSurfaceHook[pixel 700x525]
, upstreamSurface false ]]]

    at
    jogamp.opengl.windows.wgl.WindowsWGLContext.makeCurrentImpl↙
(WindowsWGLContext.java:411)

    at jogamp.opengl.GLContextImpl.makeCurrentWithinLock↙
(GLContextImpl.java:834)

    at jogamp.opengl.GLContextImpl.makeCurrent(GLContextImpl.java:642)

    at jogamp.opengl.GLContextImpl.makeCurrent(GLContextImpl.java:580)

    at jogamp.opengl.GLDrawableHelper.invokeGLImpl(GLDrawableHelper.↙
java:1263)

    at jogamp.opengl.GLDrawableHelper.invokeGL(GLDrawableHelper.java:↙
1131)

    at
    com.jogamp.opengl.awt.GLJPanel$OffscreenBackend.doPlainPaint↙
(GLJPanel.java:2110)

    at com.jogamp.opengl.awt.GLJPanel.print(GLJPanel.java:919)

    at
    com.mathworks.hg.peer.JavaSceneServerGLJPanel.print↙
(JavaSceneServerGLJPanel.java:134)

    at javax.swing.JComponent.printAll(JComponent.java:1148)

    at
    com.mathworks.hg.peer.↙
HeavyweightLightweightContainerFactory$PrintHelper.printAllComponents↙
(HeavyweightLightweightContainerFactory.java:512)

    at
    com.mathworks.hg.peer.↙
HeavyweightLightweightContainerFactory$FigurePanelContainerLight.↙
printAll(HeavyweightLightweightContainerFactory.java:495)
```

```
    at javax.swing.JComponent.paintChildren(JComponent.java:896)

    at javax.swing.JComponent.printChildren(JComponent.java:1233)

    at javax.swing.JComponent.paint(JComponent.java:1068)

    at
    com.mathworks.hg.peer.FigureClientProxyPanel.paint↙
(FigureClientProxyPanel.java:89)

    at javax.swing.JComponent.print(JComponent.java:1202)

    at javax.swing.JComponent.printAll(JComponent.java:1148)

    at
    com.mathworks.hg.util.HGGetframeOutputHelper$1.run↙
(HGGetframeOutputHelper.java:129)

    at com.mathworks.jmi.AWTUtilities$Invoker$5$1.run(AWTUtilities.↙
java:591)

    at com.mathworks.mvm.context.ThreadContext$1.call(ThreadContext.↙
java:76)

    at
    com.mathworks.mvm.context.ThreadContext.callWithContext↙
(ThreadContext.java:105)

    at com.mathworks.mvm.context.ThreadContext.runWithContext↙
(ThreadContext.java:73)

    at com.mathworks.mvm.context.MvmContext.runWithContext(MvmContext.↙
java:107)

    at com.mathworks.jmi.AWTUtilities$Invoker$5.runWithOutput↙
(AWTUtilities.java:588)

    at com.mathworks.jmi.AWTUtilities$Invoker$2.watchedRun↙
(AWTUtilities.java:475)

    at com.mathworks.jmi.AWTUtilities$WatchedRunnable.run↙
(AWTUtilities.java:436)

    at com.mathworks.jmi.AWTUtilities$Invoker.invoke(AWTUtilities.↙
```

```
java:490)

    at com.mathworks.jmi.AWTUtilities.invokeAndWait(AWTUtilities.java:↙
304)

    at
    com.mathworks.hg.util.HGGetframeOutputHelper.generateOutput↙
(HGGetframeOutputHelper.java:142)

    ... 33 more


Error in alternatePrintPath

Error in print (line 83)
pj = alternatePrintPath(pj);

Error in sir_macro (line 225)
print -dpdf -fillpage SIRmacro_epidemic_simulation_fig2

>> aggCons_trough_percent=min((100*(aggC-crss)/crss))
aggCons_avg_first_year_percent=mean((100*(aggC(1:52)-crss)/crss))
terminal_one_minus_susceptibles_percent=100*(1-S(end))
peak_infection_percent=max(100*I)
terminal_death_share_percent=100*D(end)
terminal_number_deaths_US_millions=terminal_death_share_percent/100*33↙
0

toc;

aggCons_trough_percent =

  -27.9784


aggCons_avg_first_year_percent =

  -16.9114


terminal_one_minus_susceptibles_percent =

   43.1342
```

```
peak_infection_percent =

    3.1968


terminal_death_share_percent =

    0.2157


terminal_number_deaths_US_millions =

    0.7117

Elapsed time is 1360.425349 seconds.
>>
```