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G = [g1, g2]

with ϵ [0, 1.5]

Starting with the initial zero finding equations:

and

We can rearrange them into the fixed point equations:

x1 = g1() = and x2 = g2() =

1. Given g1 and g2 we can see that these functions are clearly continuous for all ϵ [0, 1.5]. Also note that g1 and g2 have continuous partial derivatives for ϵ [0, 1.5]. Notice that:

g1() =

g2() =

since G( ϵ [0, 1.5] for each g, this implies the existence of a fixed point.

Furthermore we can show that this fixed point is unique

So all partial derivatives are bounded by .

1. Running regular fixed point iteration on this system with E = 1e-5 and an initial guess of we get the following iterations.

k| x1| x2| norm(x(n)-x(n-1))

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01 0.80000 0.80000 0.80000

02 0.92800 0.93120 0.13120

03 0.97283 0.97327 0.04483

04 0.98937 0.98944 0.01653

05 0.99578 0.99579 0.00642

06 0.99832 0.99832 0.00254

07 0.99933 0.99933 0.00101

08 0.99973 0.99973 0.00040

09 0.99989 0.99989 0.00016

10 0.99996 0.99996 0.00006

11 0.99998 0.99998 0.00003

12 0.99999 0.99999 0.00001

13 1.00000 1.00000 0.00000

1. Now using the Gauss-Seidel method of iteration with the same tolerance of E=1e-5 and the same initial guess of , we see a slight improvement in the number of iterations required.

k| x1| x2| norm(x(n)-x(n-1))

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01 0.80000 0.88000 0.88000

02 0.94144 0.96705 0.14144

03 0.98215 0.99006 0.04071

04 0.99448 0.99693 0.01234

05 0.99829 0.99905 0.00380

06 0.99947 0.99970 0.00118

07 0.99983 0.99991 0.00037

08 0.99995 0.99997 0.00011

09 0.99998 0.99999 0.00004

10 0.99999 1.00000 0.00001

11 1.00000 1.00000 0.00000