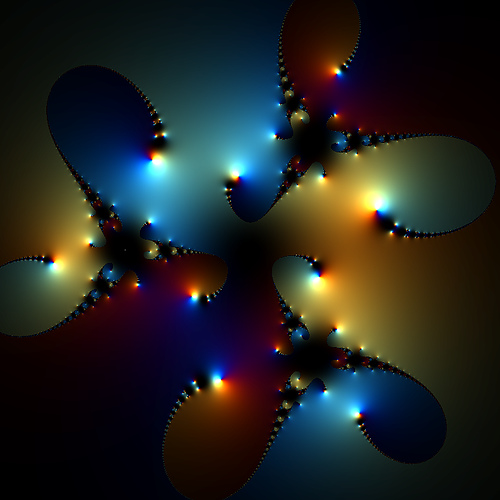
Demo – Using fsolve to solve the “ladder” problem  
Course Notes for CHEN 3600  
Computer Aided Chemical Engineering  
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The MATLAB routine fsolve is used to solve sets of nonlinear algebraic equations using

a quasi-Newton method. The user must supply a routine to evaluate the function vector.

This technique may be used to solve the “ladders in the alley” problem.

A simpler system is solved as an example:

Consider the following system of nonlinear equations, and solve for x1 and x2:

x - 4x2 = x y (1)  
2y – y2 = 3xy (2)

Put the equations in standard form, that is f(x) = 0. Note: There will be two functional equations and two variables.

f1(x, y) = x - 4x2 - x y (3)  
f2(x, y) = 2y – y2 - 3xy (4)

Rewrite again using a vector for the unknowns.

f1(x1, x2) = x1 - 4x12 – x1 x2 (3)  
f2(x1, x2) = 2x2 – x22 - 3x1x2 (4)

Create a MATLAB function containing these functions. Save the function as demo\_fsolve.m.

function [f] = demo\_fsolve(x)

f(1)=x(1)-4\*x(1)^2-x(1)\*x(2);

f(2)=2\*x(2)-x(2)^2+3\*x(1)\*x(2);

end

Give initial values (root guesses) for the unknown vector x.

>> xguess=[1 1];

>> x=fsolve('demo\_fsolve',xguess)

Equation solved.

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

x = 0.2500 0.0000