“fmincon” function in MATLAB

Finds the minimum of a problem specified by

\[
\min_{x} f(x) \text{ such that } \begin{cases} 
    c(x) \leq 0 \\
    ceq(x) = 0 \\
    A \cdot x \leq b \\
    Aeq \cdot x = beq \\
    lb \leq x \leq ub, 
\end{cases}
\]

\(x, b, beq, lb,\) and \(ub\) are vectors, \(A\) and \(Aeq\) are matrices, \(c(x)\) and \(ceq(x)\) are functions that return vectors, and \(f(x)\) is a function that returns a scalar. \(f(x),\) \(c(x),\) and \(ceq(x)\) can be nonlinear functions.

Syntax: \[[x,fval] = \text{fmincon}(\text{fun},x0,A,b,Aeq,beq,lb,ub,nonlcon,options)\]

Algorithms: 3 algorithms can be chosen by specifying a parameter in options structure. They are 'interior-point', 'active-set', or the default, 'trust-region-reflective'. They are most effective in different situations (large scale, sparse matrix, etc.). Some algorithms require you to calculate the Jacobian or Hessian matrix as input.

Search fmincon in MATLAB Help to get a very detailed description.

Create animation in figure window in MATLAB

Suppose that you have an matrix or array \(A\) which represents the figure you want to show in the figure window and \(A\) varies over time \((A(t))\), you can make the process an animation in MATLAB.

For the first frame, draw \(A(1)\) and keep the handle of the graphic object \((h)\). In next frame, update ‘XData’ and ‘YData’ field of the object (could be ‘CData’ field if \(A\) is an 2D or more D image matrix) and then use pause(0.01) (just a small time period, not necessarily 0.01) to allow redrawing. Here is an example to draw \(\sin(t)\) when \(t\) changes from 0 to \(\pi\).

```matlab
X = [0]; Y=[0]; % initial value
Figure();
h = plot(X,Y); % keep the handle
For t=0:0.1:pi % for every frame
    X = [X t]; Y=[Y sin(t)]; % new X and Y data for this frame
    Set(h,’XData’,X,’YData’,Y); % update graphic object
    Pause(0.01);
end
```