

# 牛顿法

2022 年 4 月 15 日

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[9]: %* 用符号变量定义函数
syms x1 x2 x3;
F = [3 * x1 - cos(x2 * x3) - 1/2, x1^2 - 81 * (x2 + 0.1)^2 + sin(x3) + 1.06,
    ↪exp(-x1 * x2) + 20 * x3 + 10 * pi / 3 - 1];
Jacobian = jacobian(F, [x1, x2, x3])

% Jacobian=jacobian([f1(x1,x2,x3),f2(x1,x2,x3),f3(x1,x2,x3)], [x1,x2,x3]);% 使用
函数句柄需要先将句柄转换为符号变量, 比较麻烦
X = zeros(3, 10);
X(:, 1) = [0, 0, 0];
format long%* 注意开启高精度显示

for j=-2:2
    X(:, 1) = [j*2, j*2, j*2];
    disp("If start at ")
    disp(X(:, 1))

    for i = 2:100
        x = X(:, i - 1);
        differ = 1;
        w = 1;

        while (differ > 0)% 牛顿下山
            X(:, i) = x -w * (subs(Jacobian, [x1, x2, x3], x')) \ (subs(F, [x1,
            ↪x2, x3], x')');
            differ = norm(subs(F, [x1, x2, x3], X(:, i)')) - norm(subs(F, [x1,
            ↪x2, x3], x'));
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        w = w / 2;

        if (w < 1e-3)% 起伏过大直接跳出
            break;
        end

    end

    if (i >= 99)
        disp("maybe do not convergent")
        break;
    end

    if (norm(X(:, i) - x) < 1e-8)
        disp(" result is ")
        disp(X(:, i))

        break;
    end

end

end
end

```

Jacobian =

```

[      3,   x3*sin(x2*x3), x2*sin(x2*x3)]
[      2*x1, - 162*x2 - 81/5,      cos(x3)]
[-x2*exp(-x1*x2), -x1*exp(-x1*x2),      20]

```

If start at

```

-4
-4
-4

```

result is  
0.498144684589491  
-0.199605895543780  
-0.528825977573387

If start at  
-2  
-2  
-2

result is  
0.498144684589491  
-0.199605895543780  
-0.528825977573387

If start at  
0  
0  
0

result is  
0.500000000000000  
0.000000000000000  
-0.523598775598299

If start at  
2  
2  
2

result is  
0.500000000000000  
0.000000000000000  
-0.523598775598299

If start at  
4

4

4

maybe do not convergent