chapter2

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第2题

- **解题思路**：该题主要需要实现一个`阻尼牛顿迭代法`，并将阻尼牛顿迭代与普通牛顿迭代法进行对比。其中阻尼牛顿迭代法中系数采用逐次折半更新。
- **代码**：我采用了matlab来实现牛顿迭代，其中主体代码如下：

```
while abs(func(x)) > err
    s = func(x) / derive(x);
    l = lambda;
    xk = x - l * s;
    if zuni
        i = 0;
        while (abs(func(xk)) >= abs(func(x)))
            l = l / 2;
            xk = x - l * s;
            i = i + 1;
        end
    end
    fprintf('in iteration step %d, lambda = %f, x = %f, f(x) = %f\n', iter_step, l,
xk, func(xk));
    iter_step = iter_step + 1;
    x = xk;
end
```

- **运行结果**：两个方程，统一设置为 $\lambda = 1, \epsilon = 1e-6$
  - 方程一，阻尼牛顿法运行结果

    ```
    result of fzero: 1.324718

    in iteration step 0, lambda = 0.031250, x = 1.140625, f(x) = -0.656643
    in iteration step 1, lambda = 1.000000, x = 1.366814, f(x) = 0.186640
    in iteration step 2, lambda = 1.000000, x = 1.326280, f(x) = 0.006670
    in iteration step 3, lambda = 1.000000, x = 1.324720, f(x) = 0.000010
    in iteration step 4, lambda = 1.000000, x = 1.324718, f(x) = 0.000000

    ans = 1.3247
    ```

  - 方程一，普通牛顿法运行结果

    ```
    result of fzero: 1.324718
    ```

```
in iteration step 0, lambda = 1.000000, x = 17.900000, f(x) = 5716.439000
in iteration step 1, lambda = 1.000000, x = 11.946802, f(x) = 1692.173533
in iteration step 2, lambda = 1.000000, x = 7.985520, f(x) = 500.239416
in iteration step 3, lambda = 1.000000, x = 5.356909, f(x) = 147.367518
in iteration step 4, lambda = 1.000000, x = 3.624996, f(x) = 43.009613
in iteration step 5, lambda = 1.000000, x = 2.505589, f(x) = 12.224443
in iteration step 6, lambda = 1.000000, x = 1.820129, f(x) = 3.209725
in iteration step 7, lambda = 1.000000, x = 1.461044, f(x) = 0.657774
in iteration step 8, lambda = 1.000000, x = 1.339323, f(x) = 0.063137
in iteration step 9, lambda = 1.000000, x = 1.324913, f(x) = 0.000831
in iteration step 10, lambda = 1.000000, x = 1.324718, f(x) = 0.000000

ans = 1.3247
```

- 方程二， 阻尼牛顿法运行结果

```
result of fzero: 2.236068

in iteration step 0, lambda = 0.125000, x = 2.496959, f(x) = -3.083249
in iteration step 1, lambda = 1.000000, x = 2.271976, f(x) = -0.367778
in iteration step 2, lambda = 1.000000, x = 2.236902, f(x) = -0.008342
in iteration step 3, lambda = 1.000000, x = 2.236068, f(x) = -0.000005
in iteration step 4, lambda = 1.000000, x = 2.236068, f(x) = -0.000000

ans = 2.2361
```

- 方程二，普通牛顿法运行结果

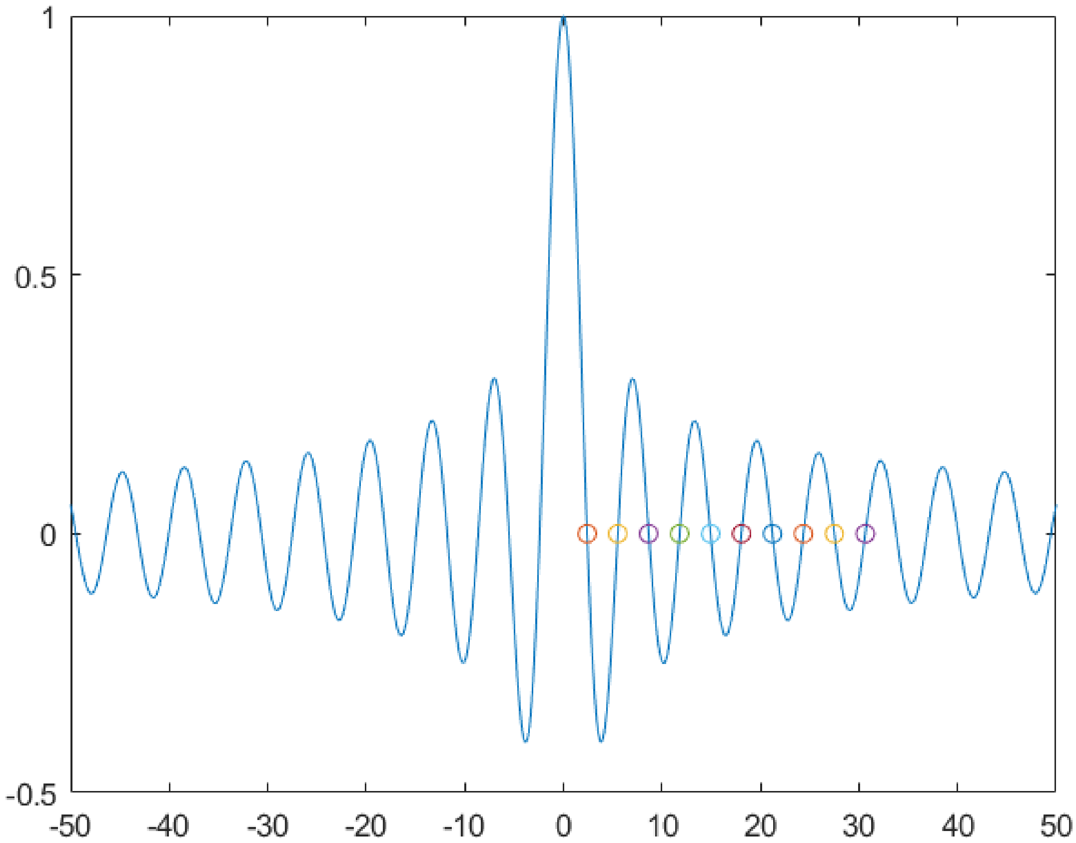
```
result of fzero: 2.236068

in iteration step 0, lambda = 1.000000, x = 10.525668, f(x) = -1113.507269
in iteration step 1, lambda = 1.000000, x = 7.124287, f(x) = -325.975011
in iteration step 2, lambda = 1.000000, x = 4.910781, f(x) = -93.873337
in iteration step 3, lambda = 1.000000, x = 3.516911, f(x) = -25.914942
in iteration step 4, lambda = 1.000000, x = 2.709743, f(x) = -6.348134
in iteration step 5, lambda = 1.000000, x = 2.336940, f(x) = -1.078004
in iteration step 6, lambda = 1.000000, x = 2.242244, f(x) = -0.062019
in iteration step 7, lambda = 1.000000, x = 2.236093, f(x) = -0.000254
in iteration step 8, lambda = 1.000000, x = 2.236068, f(x) = -0.000000

ans = 2.2361
```

- **总结**：可以看到无论是普通牛顿迭代法还是阻尼牛顿迭代法，求得的解的结果与 `fzero` 函数的结果在小数点后4位都是正确的，可以看到两种方法的正确性。同时，对比一些 阻尼牛顿法和普通牛顿法，可以看到这两个方程只有在第一轮迭代时，lambda的值才会不等于1，其余时间均等于1，收敛速度很快。

第3题

- **解题思路**：该题主要是要应用书中给出的 `fzerotx` 的代码，再画出函数图像，观察图像，给出十个可能的解的区间及初值，调用函数来求解。

- **函数图像**：



- **零点**：

```
    2.4048
    5.5201
    8.6537
   11.7915
   14.9309
   18.0711
   21.2116
   24.3525
   27.4935
   30.6346
```