Calcul numeric - temă de laborator

Gabriel Luican, grupa 10LD521

Februarie - Iunie 2024

Enunţ: Capitolul 12, Subcapitolul II, Problema 1

Să se calculeze functiile de aproximare construite prin metoda celor mai mici patrate pentru metoda Gauss-Newton de forma si datele indicate (t = 0:9)

$$\varphi(t) = a\ln(bt + c) \qquad y = 2\ln(3t + 1)$$

Soluţie

$$t = 0 : 9$$
$$y = 2 * log(3 * t + 1)$$
$$errors = @(params)y - model(params, t)$$
$$init_params = [1, 1, 1]$$
$$errors = @(params)y - model(params, t)$$
$$options = optimoptions('lsqnonlin',' Display',' iter')$$
$$estim_params = lsqnonlin(errors, init_params, [], [], options)$$

$$\begin{pmatrix} Iter & Func-count & Resnorm & Normofstep & First-Orderoptim \\ 0 & 4 & 118.355 & & 56.9 \\ 1 & 8 & 1.35224 & 3.12972 & 10.1 \\ 2 & 12 & 0.463972 & 1.41045 & 5.22 \\ 3 & 16 & 0.00089738 & 0.313499 & 0.24 \\ 4 & 20 & 1.70337e-10 & 0.00984437 & 0.000105 \\ 5 & 24 & 1.30888e-24 & 2.06829e-06 & 9.03e-12 \end{pmatrix}$$

$$estim_param = \begin{pmatrix} 2.0000 & 3.0000 & 1.0000 \end{pmatrix}$$

$$\begin{pmatrix} t & y_real & y_apprx \\ 0 & 0 & 5.7732e-15 \\ 1 & 2.7726 & 2.7726 \\ 2 & 3.8918 & 3.8918 \\ 3 & 4.6052 & 4.6052 \\ 4 & 5.1299 & 5.1299 \\ 5 & 5.5452 & 5.5452 \\ 6 & 5.8889 & 5.8889 \\ 7 & 6.1821 & 6.1821 \\ 8 & 6.4378 & 6.4378 \\ 9 & 6.6644 & 6.6644 \end{pmatrix}$$

Observaţii

```
>> t = 0:9;
>> y = 2 * log(3 * t + 1);
>> model = @(params, t) params(1) * log(params(2) * t + params(3));
>> errors = @(params) y - model(params, t);
>> init_params = [1,1,1];
>> options = optimoptions('lsqnonlin', 'Display', 'iter');
>> estim_params = lsqnonlin(errors, init_params, [], [], options);

                                         Norm of      First-order
 Iteration  Func-count      Resnorm          step       optimality
     0          4           118.355                         56.9
     1          8           1.35224        3.12972            10.1
     2         12          0.463972        1.41045            5.22
     3         16        0.00089738       0.313499            0.24
     4         20       1.70337e-10     0.00984437        0.000105
     5         24       1.30888e-24     2.06829e-06        9.03e-12
Local minimum found.

Optimization completed because the size of the gradient is less than
the value of the optimality tolerance.

<stopping criteria details>
>> disp('Parametrii estimati:');
disp(estim_params);
Parametrii estimati:
    2.0000    3.0000    1.0000

>> apprx_y = model(estim_params, t);
>> disp('Valorile reale si approximate');
disp(table(t', y', apprx_y', 'VariableNames', {'t', 'y_real', 'y_apprx'}));
```

Valorile reale si approximate

t	y_real	y_apprx
0	0	5.7732e-15
1	2.7726	2.7726
2	3.8918	3.8918
3	4.6052	4.6052
4	5.1299	5.1299
5	5.5452	5.5452
6	5.8889	5.8889
7	6.1821	6.1821
8	6.4378	6.4378
9	6.6644	6.6644