08 – KBC Name: ___________________

FOR EACH TASK, YOU CAN OBTAIN 1 CREDIT.

In the task, we are asked to compute minima of given objective functions.

1. Gradient of the Rosenbrock function

$$F(x_1, x_2) = 100(x_2 - x_1^2)^2 + (1 - x_1)^2$$

should be evaluated analytically. The analytic expression for the gradient should be implemented in a MATLAB script

```
function sda( alpha)
```

for computing the minimum of the function by the steepest descent method. The script should perform $N = 10^4$ iteration steps. The function should be called with the step of descent $\alpha = 10^{-2}$, 10^{-3} and 10^{-4}. The optimization should be started from $x = [\,-1 \;\; +1]^T$.

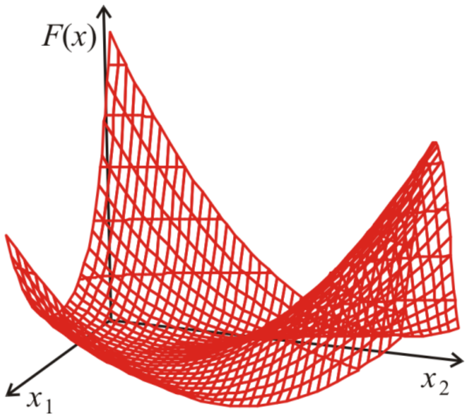

Fig. 1 *Rosenbrock function.*

2. The script for the steepest descent computation of the minimum of Rosenbrock function should be rewritten for a numerical evaluation of the gradient (partial derivatives are approximated by finite differences)

```
function sdn( h)
```

The starting point of the optimization is again $x = [\,-1 \;\; +1]^T$. The step of descent is set to $\alpha = 10^{-3}$, and the number of iteration steps equals to $N = 10^4$. The function should be called with the length of the finite difference $h = 10^{-1}$, 10^{-2} and 10^{-3}.

3. The analytical evaluation of the gradient should be completed by the analytical evaluation of the Hessian, and the minimum of the Rosenbrock function should be computed by Newton method. The search is expected to execute $N = 10$ iteration steps. The search should be started from points $x_A = [\,-1 \;\; +1]^T$, $x_B = [\,-2 \;\; +2]^T$ and $x_C = [\,-3 \;\; +3]^T$.

4. The Newton method based on analytical relations should be replaced by a numerical approach replacing derivatives by finite differences.