

IT в инженерных расчетах. Лань. 2023

Рис. 3.21. Решение задачи об одной, пяти и 21 коробке максимального объема

$$a := 1 \text{ м} \quad V_1(x) := (a - 2 \cdot a \cdot x)^2 \cdot a \cdot x$$

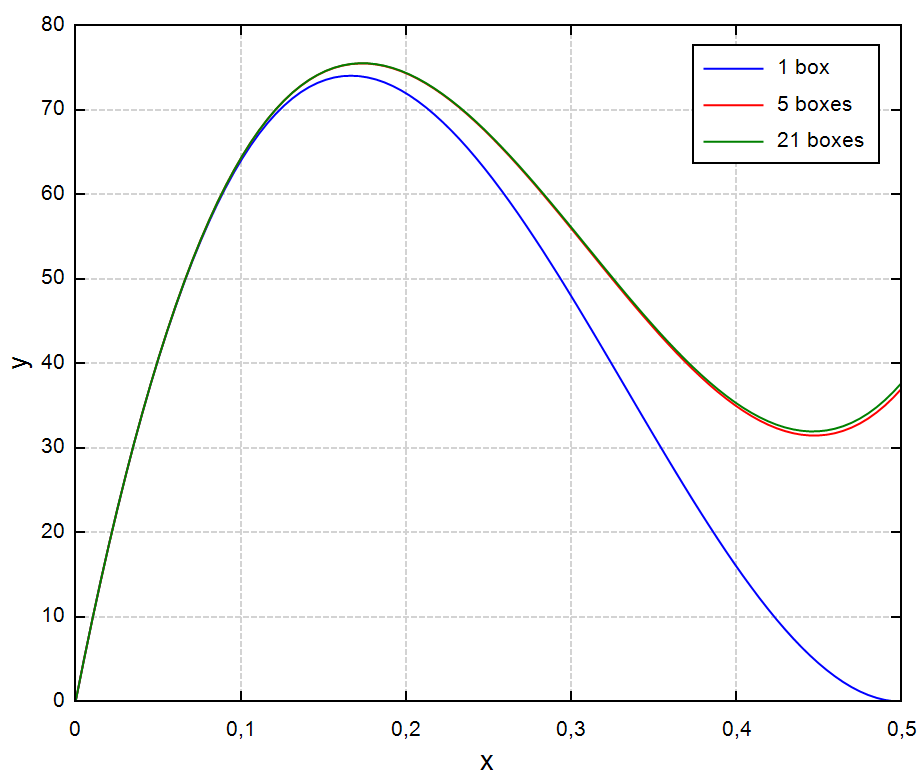
$$x_{opt1} := \text{solve} \left(\frac{d}{d x} V_1(x); x; 0, 1; 0, 2 \right) = 0,166666833416708$$

$$V_5(x) := V_1(x) + 4 \cdot (a \cdot x - 2 \cdot a \cdot x \cdot x_{opt1})^2 \cdot a \cdot x \cdot x_{opt1}$$

$$x_{opt5} := \text{solve} \left(\frac{d}{d x} V_5(x); x; 0, 1; 0, 2 \right) = 0,173495629755386$$

$$V_{21}(x) := V_5(x) + 16 \cdot (a \cdot x \cdot x_{opt1} - 2 \cdot a \cdot x \cdot x_{opt1} \cdot x_{opt5})^2 \cdot a \cdot x \cdot x_{opt1} \cdot x_{opt5}$$

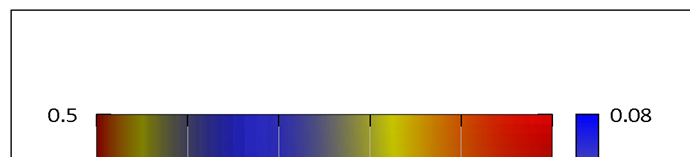
$$x_{opt21} := \text{solve} \left(\frac{d}{d x} V_{21}(x); x; 0, 1; 0, 2 \right) = 0,173636386244198$$

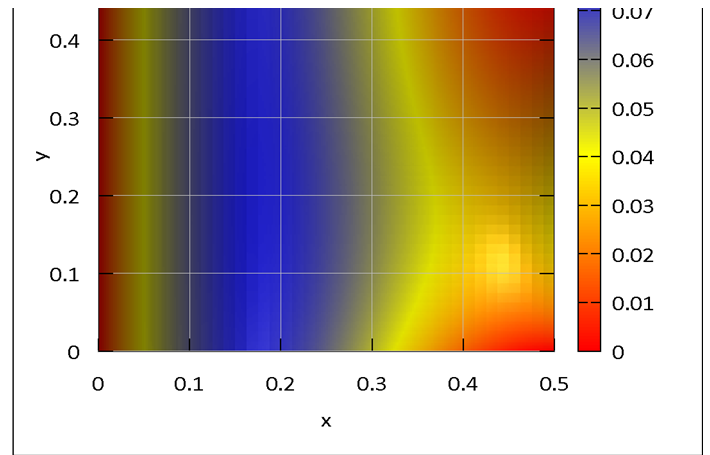
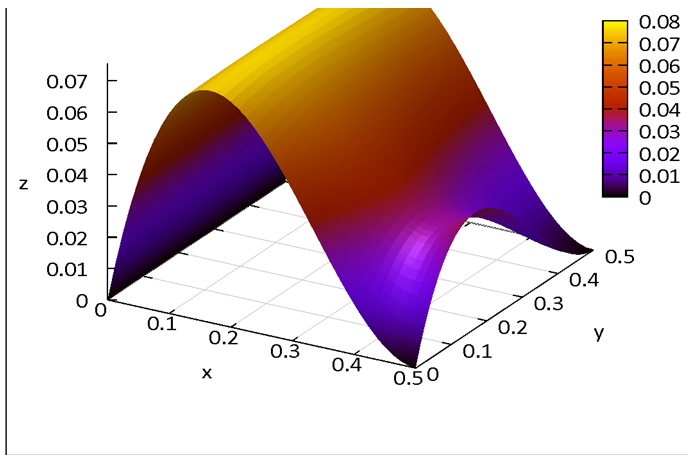


$$\left\{ \begin{array}{l} \frac{V_1(x)}{L} \\ \frac{V_5(x)}{L} \\ \frac{V_{21}(x)}{L} \end{array} \right.$$

☒ Draw-Descriptions (Maxima)

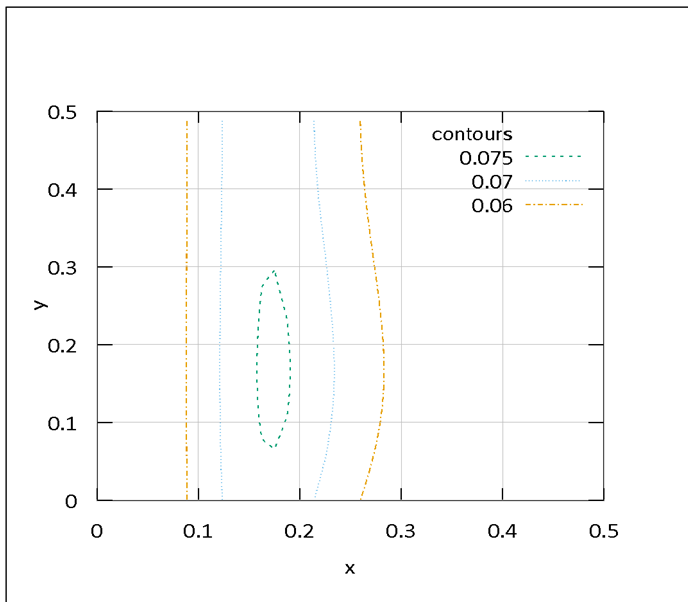
$$f := (a - 2 \cdot a \cdot x)^2 \cdot a \cdot x + 4 \cdot (a \cdot x - 2 \cdot a \cdot x \cdot y)^2 \cdot a \cdot x \cdot y$$





```
{ explicit (f; x; 0; 0,5; y; 0; 0,5)
  interpolate_color = true
  xyplane = 0
```

```
{ explicit (f; x; 0; 0,5; y; 0; 0,5)
  interpolate_color = true
  palette = { red
            yellow
            blue
```



```
{ key = "contours"
  explicit (f; x; 0; 0,5; y; 0; 0,5)
  interpolate_color = true
  contour = map
  contour_levels = set (0,06; 0,07; 0,075)
  colorbox = false
```

Unit-proof integrator, Jacobian and Newton Solver with line search

$$Eq := \begin{cases} \frac{d}{d x} f \\ \frac{d}{d y} f \end{cases} = \begin{cases} m^3 \cdot \left((1-2 \cdot x)^2 + 4 \cdot x \cdot \left(-1 + 2 \cdot x \cdot \left(1 + (1-2 \cdot y)^2 \cdot y \right) + x \cdot (1-2 \cdot y)^2 \cdot y \right) \right) \\ -4 \cdot x^3 \cdot m^3 \cdot (1-2 \cdot y) \cdot (-1 + 6 \cdot y) \end{cases}$$

$$\begin{bmatrix} x \\ y \end{bmatrix} := NR \left(Eq; \begin{bmatrix} x \\ y \end{bmatrix}; \begin{bmatrix} 0,2 \\ 0,2 \end{bmatrix}; 0,0001; 0,0001 \right) = \begin{bmatrix} 0,1735 \\ 0,1667 \end{bmatrix} \quad f = 75,5 \text{ L}$$