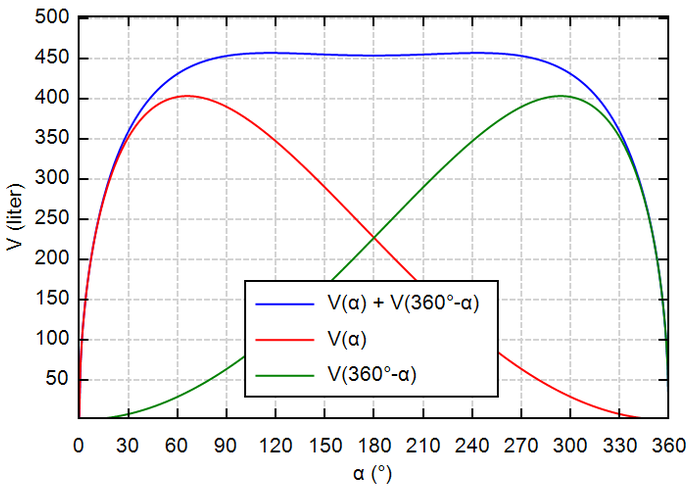
IT в инженерных расчетах. Лань. 2023

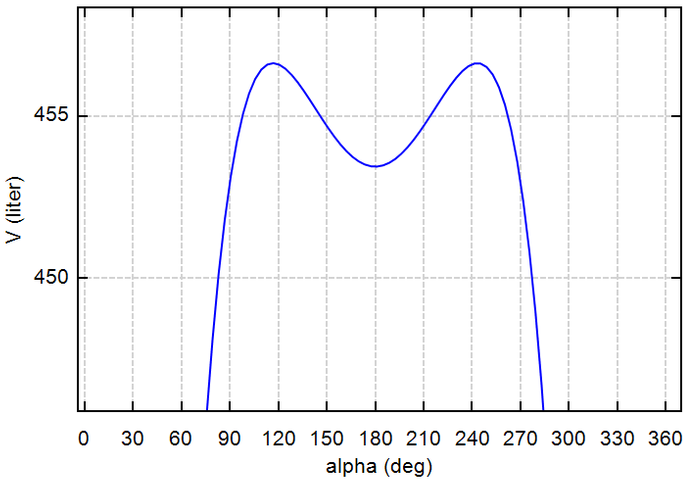
Рис. 3.27. Графическое и численное решение задачи об одном и двух конических емкостях

$R := 1\ \mathrm{m}$ $\quad r(\alpha) := R \cdot \left(1 - \frac{\alpha}{2 \cdot \pi}\right)$ $\quad h(\alpha) := \sqrt{R^2 - r(\alpha)^2}$

Martin Kraska, 10/23, Maxima-3D-Diagramme

$V_1(\alpha) := \frac{1}{3} \cdot \pi \cdot r(\alpha)^2 \cdot h(\alpha)$ $\quad V_2(\alpha) := V_1(\alpha) + V_1(2 \cdot \pi - \alpha)$





$$\begin{cases} \frac{V_1(\alpha\ °)}{\mathrm{L}} + \frac{V_1((360-\alpha)\ °)}{\mathrm{L}} \\ \frac{V_1(\alpha\ °)}{\mathrm{L}} \\ \frac{V_1((360-\alpha)\ °)}{\mathrm{L}} \end{cases} \qquad \frac{V_2(\alpha\ °)}{\mathrm{L}}$$

$\mathrm{solve}\left(\frac{d}{d\alpha} V_1(\alpha) = 0;\ \alpha;\ 0;\ \pi\right) = \begin{bmatrix} 1{,}1433 \\ 1{,}153 \end{bmatrix}$

$\alpha_{opt1} := \mathrm{roots}\left(\frac{d}{d\alpha} V_1(\alpha) = 0;\ \alpha;\ 1\right) = 66{,}061\ °$ $\quad V_1(\alpha_{opt1}) = 403{,}07\ \mathrm{L}$

$\begin{bmatrix} \alpha_{opt2} \\ No \\ No \end{bmatrix} := \left(\mathrm{solve}\left(\frac{d}{d\alpha} V_2(\alpha) = 0;\ \alpha\right)\right) = \begin{bmatrix} 116{,}65 \\ 180 \\ 243{,}35 \end{bmatrix}\ °$ $\quad V_2(\alpha_{opt2}) = 456{,}64\ \mathrm{L}$

$\alpha_{opt2} := \mathrm{roots}\left(\frac{d}{d\alpha} V_2(\alpha) = 0;\ \alpha;\ 2\right) = 116{,}64\ °$ $\quad V_2(\alpha_{opt2}) = 456{,}64\ \mathrm{L}$

MaximaControl("restart") = "Restart complete."

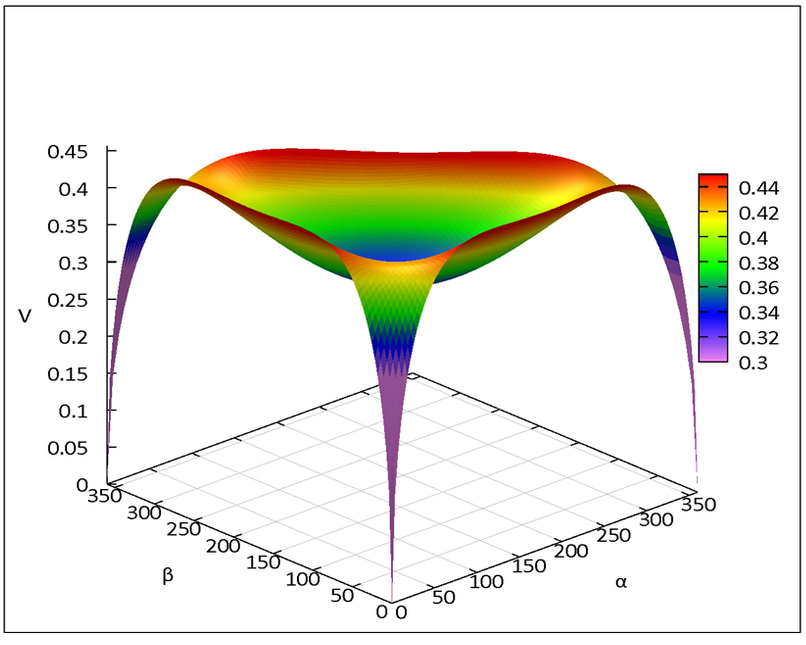
$r(\alpha) := \frac{\alpha}{2 \cdot \pi}$ $h(\alpha) := \sqrt{1 - r(\alpha)^2}$ $V(\alpha) := \frac{1}{3} \cdot \pi \cdot r(\alpha)^2 \cdot h(\alpha)$

$\Sigma V(\alpha ; \beta) := V(\alpha) + V(\beta) + V(2 \cdot \pi - \alpha - \beta)$

$$C := \begin{cases} \alpha > 0 \\ \beta > 0 \\ \alpha + \beta < 360\ ° \end{cases}$$

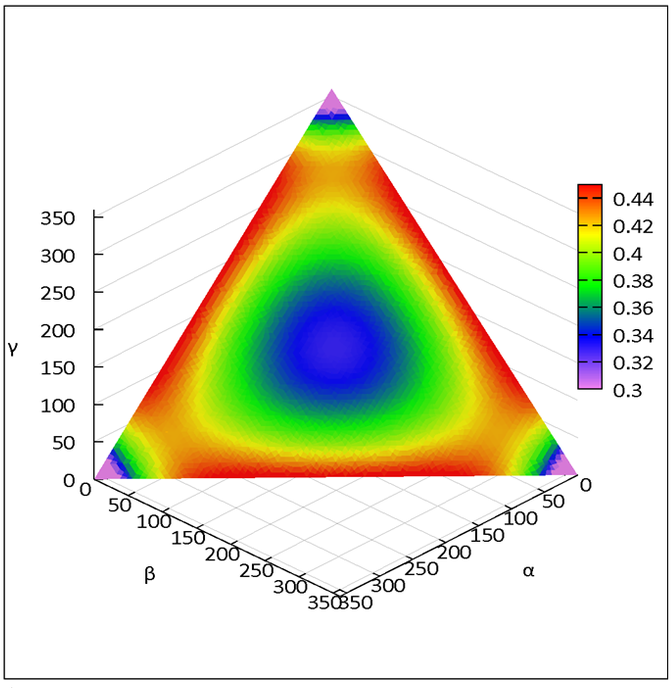
Draw-Descriptions (Maxima)

$$P := \begin{cases} parametric\_surface\left(360 \cdot x ; 360 \cdot (1-x) \cdot y ; \Sigma V\left(2 \cdot \pi \cdot x ; 2 \cdot \pi \cdot (1-x) \cdot y\right) ; x ; 0 ; 1 ; y ; 0 ; 1\right) \\ palette = \begin{cases} violet \\ blue \\ green \\ yellow \\ red \end{cases} \\ xyplane = 0 \\ cbrange = \begin{cases} 0,3 \\ 0,45 \end{cases} \end{cases}$$



P

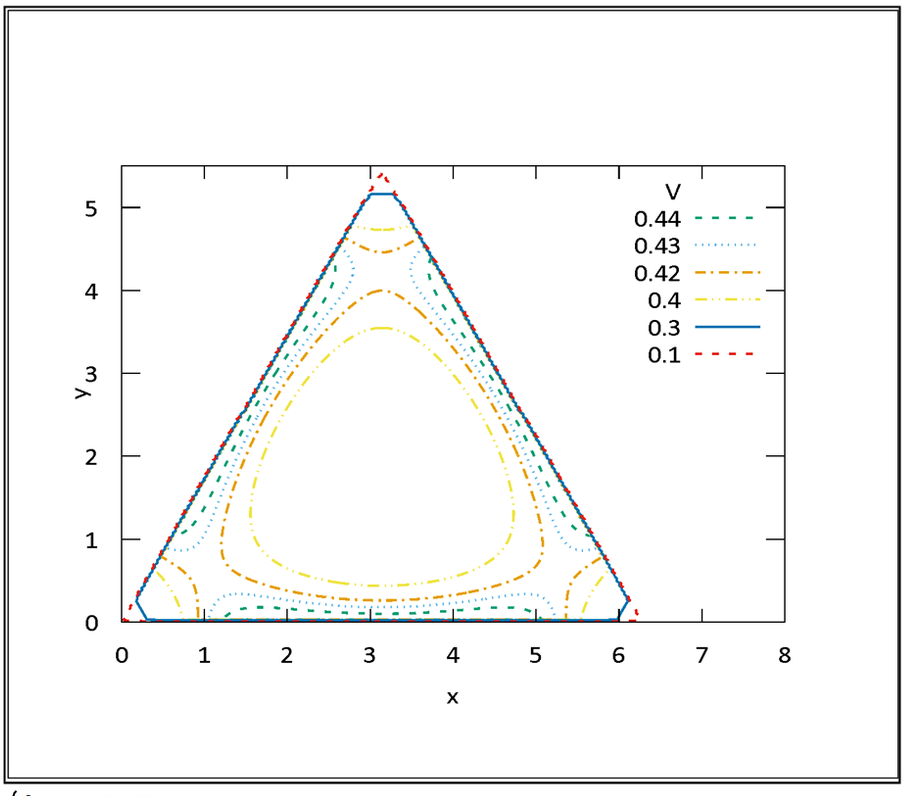
$$P := \begin{cases} x\_voxel = 25 \\ y\_voxel = 25 \\ z\_voxel = 25 \\ cbrange = \begin{cases} 0,3 \\ 0,45 \end{cases} \\ enhanced3d = \begin{cases} \Sigma V(\alpha\ °; \beta\ °) \\ \alpha \\ \beta \\ \gamma \end{cases} \\ xyplane = 0 \\ interpolate\_color = \begin{cases} 3 \\ 3 \end{cases} \\ palette = \begin{cases} violet \\ blue \\ green \\ yellow \\ red \end{cases} \end{cases}$$



$$\begin{cases} P \\ implicit\left(\alpha + \beta + \gamma = 360 ; \alpha ; 0 ; 360 ; \beta ; 0 ; 360 ; \gamma ; 0 ; 360\right) \end{cases}$$

$$V := \Sigma V(\alpha;\beta)\cdot charfun\left(\left(\left(C_1\right)\wedge\left(C_2\right)\right)\wedge\left(C_3\right)\right)\left|\begin{cases}\alpha = x - y\cdot \mathrm{ctg}\left(\frac{\pi}{3}\right)\\ \beta = \frac{y}{\sin\left(\frac{\pi}{3}\right)}\end{cases}\right.$$

$$C := \begin{cases}\alpha > 0\\ \beta > 0\\ \alpha + \beta < 360\ °\end{cases}$$



$$\begin{cases}key = "V"\\ line\_width = 2\\ explicit(V; x; 0; 2\cdot\pi; y; 0; 5{,}5)\\ contour = map\\ colorbox = false\\ contour\_levels = set(0{,}1; 0{,}3; 0{,}4; 0{,}4; 0{,}42; 0{,}43; 0{,}44)\end{cases}$$