

Аналитико-графическое решение задачи о размерах подводной лодки «Наутилус»

Analytical-graphical solution of the problem of the size of the submarine "Nautilus"

<http://twtsheell.ru/ochkov/Nautilus.pdf>

$$V = \frac{1}{3} \cdot \pi \cdot r^2 \cdot h_1 + \pi \cdot r^2 \cdot l + \frac{1}{3} \cdot \pi \cdot r^2 \cdot h_2 \quad \text{Объем лодки}$$

$$\text{maple} \left(\text{solve} \left(V = \frac{1}{3} \cdot \pi \cdot r^2 \cdot h_1 + \pi \cdot r^2 \cdot l + \frac{1}{3} \cdot \pi \cdot r^2 \cdot h_2, l \right) \right) = - \frac{-3 \cdot V + \pi \cdot r^2 \cdot (h_1 + h_2)}{3 \cdot \pi \cdot r^2}$$

$$S = \pi \cdot r \cdot \sqrt{r^2 + h_1^2} + 2 \cdot \pi \cdot r \cdot l + \pi \cdot r \cdot \sqrt{r^2 + h_2^2} \quad \text{Площадь поверхности}$$

$$\text{maple} \left(\text{solve} \left(S = \pi \cdot r \cdot \sqrt{r^2 + h_1^2} + 2 \cdot \pi \cdot r \cdot l + \pi \cdot r \cdot \sqrt{r^2 + h_2^2}, l \right) \right) = - \frac{-S + \pi \cdot r \cdot \left(\sqrt{r^2 + h_1^2} + \sqrt{r^2 + h_2^2} \right)}{2 \cdot \pi \cdot r}$$

$$V := 1500$$

$$S := 1000$$

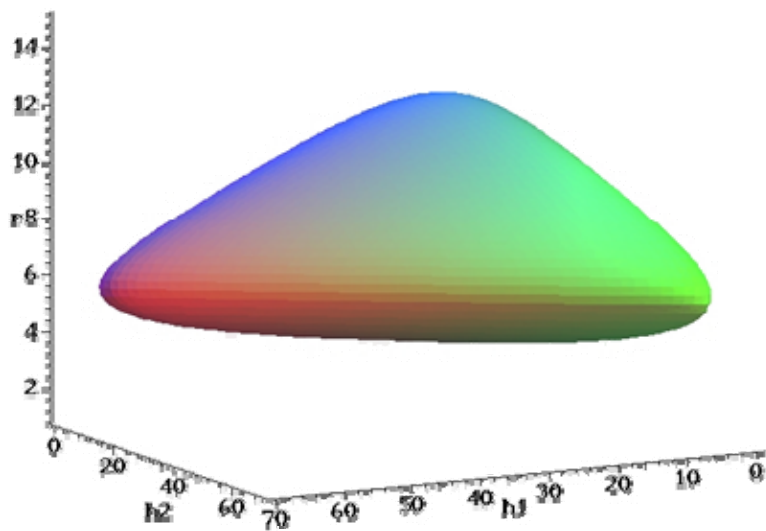
$$f(x, y, z) := \frac{\pi \cdot y^2 \cdot (x + z) - 3 \cdot V}{3 \cdot \pi \cdot y^2} - \frac{\pi \cdot y \cdot \left(\sqrt{y^2 + x^2} + \sqrt{y^2 + z^2} \right) - S}{2 \cdot \pi \cdot y}$$

$$f(x, y, z) := \frac{\pi \cdot z^2 \cdot (x + y) - 3 \cdot V}{3 \cdot \pi \cdot z^2} - \frac{\pi \cdot z \cdot \left(\sqrt{z^2 + x^2} + \sqrt{z^2 + y^2} \right) - S}{2 \cdot \pi \cdot z}$$

$$[xmn \ xmx] := [-0 \ 70] \quad [ymn \ ymx] := [-0 \ 70] \quad [zmn \ zmx] := [1 \ 15] \quad nm := \text{"plot1"}$$

$$\theta := 60 \quad \varphi := 90 \quad [gx \ gy \ gz] := [50 \ 50 \ 50] \quad xl := \text{"h1"} \quad yl := \text{"h2"} \quad zl := \text{"r"}$$

 implicitplot3d



$$f(x, y, z)$$

```

> restart
> LV := solve( V =  $\frac{1}{3}\pi \cdot R^2 \cdot H_1 + \pi \cdot R^2 \cdot L + \frac{1}{3}\pi \cdot R^2 \cdot H_2, L$  )


$$LV := -\frac{1}{3} \frac{H_1 \pi R^2 + H_2 \pi R^2 - 3 V}{\pi R^2} \quad (1)$$


> LS := solve( S =  $\pi \cdot R \cdot (H_1^2 + R^2)^{\frac{1}{2}} + 2 \pi \cdot R \cdot L + \pi \cdot R \cdot (H_2^2 + R^2)^{\frac{1}{2}}, L$  )


$$LS := -\frac{1}{2} \frac{\pi R \sqrt{H_1^2 + R^2} + \pi R \sqrt{H_2^2 + R^2} - S}{\pi R} \quad (2)$$


> f := LV = LS


$$f := -\frac{1}{3} \frac{H_1 \pi R^2 + H_2 \pi R^2 - 3 V}{\pi R^2} = -\frac{1}{2} \frac{\pi R \sqrt{H_1^2 + R^2} + \pi R \sqrt{H_2^2 + R^2} - S}{\pi R} \quad (3)$$


> V := 1500 : S := 1010 :
> with(plots) :
> implicitplot3d(f, H1 = -20 .. 70, R = 1 .. 15, H2 = -20 .. 70, numpoints = 10000)

```

