Plochy – potrava pro oko

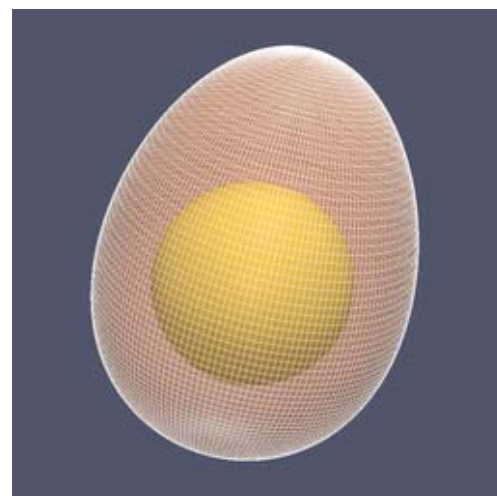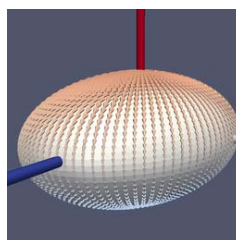## Kulová plocha

$$x = r\sin\vartheta\cos\varphi, \quad 0 \le \vartheta \le \pi,\ 0 \le \varphi \le 2\pi$$
$$y = r\sin\vartheta\sin\varphi$$
$$z = r\cos\vartheta$$

$$x^2 + y^2 + z^2 - r^2 = 0$$

Trojosý elipsoid
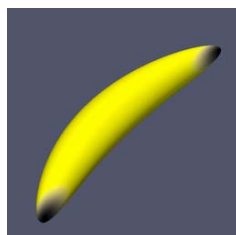
$$x = a\sin\vartheta\cos\varphi, \quad 0 \le \vartheta \le \pi,\ 0 \le \varphi \le 2\pi$$
$$y = b\sin\vartheta\sin\varphi$$
$$z = c\cos\vartheta$$

$$\left(\frac{x}{a}\right)^2 + \left(\frac{y}{b}\right)^2 + \left(\frac{z}{c}\right)^2 - 1 = 0$$

Banán

$$x = a\sin\vartheta\cos\varphi, \quad 0 \le \vartheta \le \pi,\ 0 \le \varphi \le 2\pi$$
$$y = b\sin\vartheta\sin\varphi$$
$$z = b(\cos\vartheta + c\sin^2\vartheta\cos^2\varphi)$$

př. $a = 1,\ b = 0.2,\ c = 2$

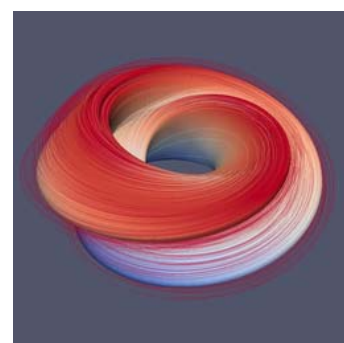## Vajíčko (http://www.mathematische-basteleien.de/eggcurves.htm)

$$x = a\sin\vartheta\cos\varphi, \quad 0 \le \vartheta \le \pi,\ 0 \le \varphi \le 2\pi$$
$$y = a\sin\vartheta\sin\varphi$$
$$z = b\cos\vartheta\sqrt{e^{c\cos\vartheta}}$$

př. $a = 1.4,\ b = 1.8,\ c = 0.3$ s kulovou plochou $r = 1$

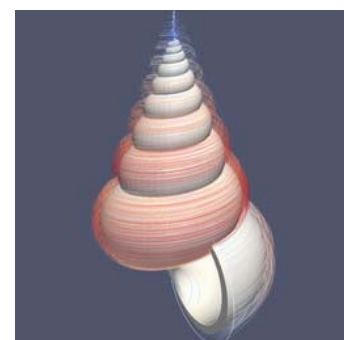## Kleinův bagel (http://en.wikipedia.org/wiki/Klein_bottle)

$$x = \left(A + \cos\tfrac{u}{2}\sin v - \sin\tfrac{u}{2}\sin 2v\right)\cos u$$
$$y = \left(A + \cos\tfrac{u}{2}\sin v - \sin\tfrac{u}{2}\sin 2v\right)\sin u \quad 0 \le u \le 2\pi,\ 0 \le v \le 2\pi$$
$$z = \sin\tfrac{u}{2}\sin v + \cos\tfrac{u}{2}\sin 2v$$

př. $A = 2.5$

Šnek (http://virtualmathmuseum.org/Surface/snailshell/snailshell.html)

$$V = v + \tfrac{1}{16}(v + E)^2$$
$$x = (A + B\cos u)e^{-CV}\cos V$$
$$y = (A + B\cos u)e^{-CV}\sin V \qquad -\pi \le u \le \pi,\ -2 \le v \le 25$$
$$z = D(1 - e^{-CV}) + Be^{-CV}\sin u$$

př. $A = 1,\ B = 1.4,\ C = 0.05,\ D = 6,\ E = -2$

Kapřík (http://en.wikipedia.org/wiki/Spherical_harmonics)

$$r(\vartheta,\varphi) = \max(|\operatorname{Re}(Y_{00})|, \ldots, |\operatorname{Re}(Y_{33})|), \quad 0 \le \vartheta \le \pi,\ 0 \le \varphi \le 2\pi$$
$$Y_{lm}(\vartheta,\varphi) = N_{lm}P_{lm}(\cos\vartheta)e^{im\varphi}, \quad N_{lm} = \sqrt{\tfrac{2l+1}{4\pi}\tfrac{(l-m)!}{(l+m)!}}$$
$$x = r(\vartheta,\varphi)\sin\vartheta\cos\varphi$$
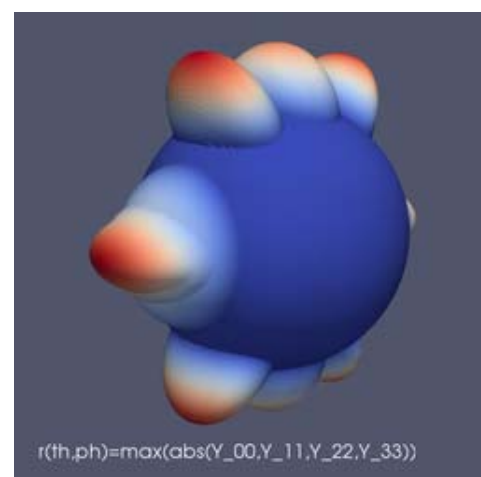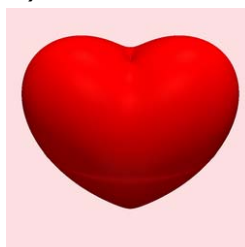$$y = r(\vartheta,\varphi)\sin\vartheta\sin\varphi$$
$$z = r(\vartheta,\varphi)\cos\vartheta$$

Srdce (http://mathworld.wolfram.com/HeartSurface.html)

$$\left(ax^2 + by^2 + cz^2 - 1\right)^3 - dx^2z^3 - ey^2z^3 = 0$$

široké srdce $\quad a = 1,\ b = \frac{9}{4},\ c = 1,\ d = 1,\ e = \frac{9}{80}$
úzký exemplář $\quad a = 2,\ b = 2,\ c = 1,\ d = 1,\ e = \frac{1}{10}$

Obrázky připraveny v **ParaView**, www.paraview.org.
L. H., 2. 2. 2016

r(th,ph)=max(abs(Y_00,Y_11,Y_22,Y_33))