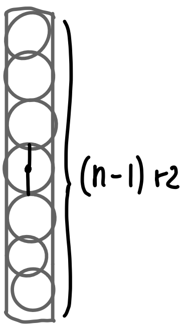
08.05.19 Collision Detection
(uploaded slides)

The sausage conjecture

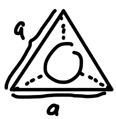
Volume of a sausage paking



$$V_{sausage} = V_{cylinder} + 2\, V_{Halfsphere}$$
$$= \pi h r^2 + \frac{4}{3}\pi r^3$$
$$= 2\pi (n-1) r^2 + \frac{4}{3}\pi r^3 \qquad (1)$$

Volume of tetrahedon

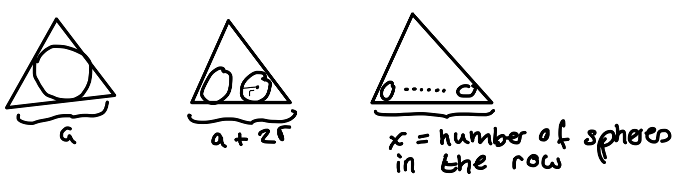
$$V_T = \frac{\sqrt{2}}{12} a^3 \qquad (2)$$



Radius of inscribed sphere

$$r = \frac{\sqrt{6}}{12} a$$

$$\Rightarrow a = 2\sqrt{6}\, r \qquad (3)$$



Tetrahedron with x spheres in the row

$$a = 2\left((x-1) + \sqrt{6}\right)\cdot r \qquad (4)$$

(4) in (2) => $V_{cluster} < \frac{\sqrt{2}}{12}\cdot\left(2\left(x-1\right) + \sqrt{6}\right)\cdot r\Big)^3$

$$< \frac{2\left(x - 1 + \sqrt{6}\right)^3 \sqrt{2} \cdot r^3}{3}$$

n = numbers of spheres with
length x spheres in one row (Thetrahedon)

$$n = \sum_{i=1}^{n} \cdot \sum_{j=1} j = \frac{x\,(x+1)(x+2)}{6} \qquad (5)$$

(5) in (1): $V_{sausage} = \frac{x\,(x+1)(x+2)-2}{3}\pi\, r^3$