2. Kinematik punktförmiger Körper

2.1 Koordinatensysteme und Bahnkurven

2.2 Geschwindigkeit und Beschleunigung

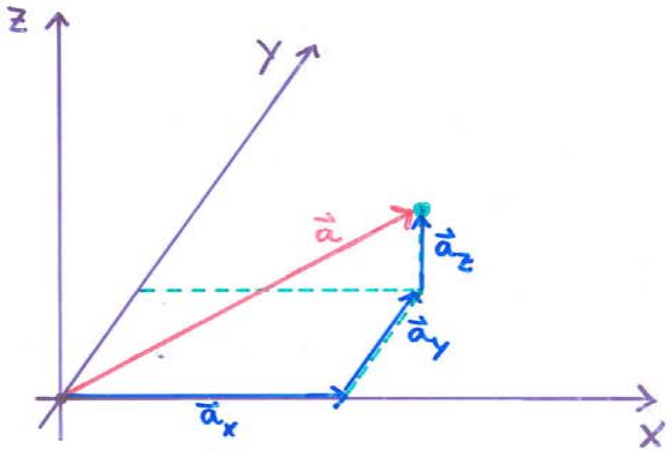
2.3 Der freie Fall und Wurfbewegungen

2.4. Die gleichförmige Kreisbewegung

Koordinatensystem

3 Raumdimensionen x, y, z

$\vec{x} \perp \vec{y} \perp \vec{z}$

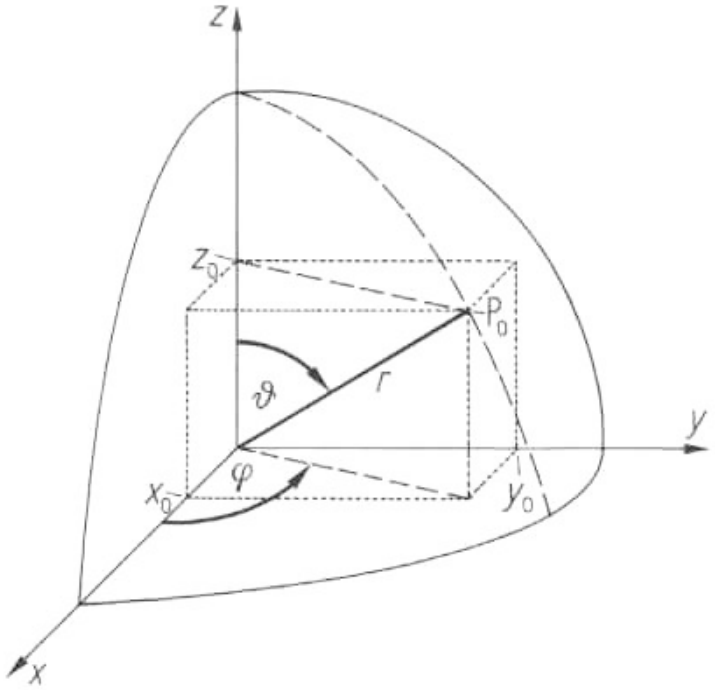


$$\vec{a} = \vec{a}_x + \vec{a}_y + \vec{a}_z$$
$$= a_x \cdot \vec{e}_x + a_y \cdot \vec{e}_y + a_z \cdot \vec{e}_z$$

$\vec{e}_x, \vec{e}_y, \vec{e}_z$ = Einheitsvektoren im x, y, z - Richtung

$$\vec{a} = \begin{pmatrix} a_x \\ a_y \\ a_z \end{pmatrix} = a_x \cdot \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} + a_y \cdot \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} + a_z \cdot \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$$

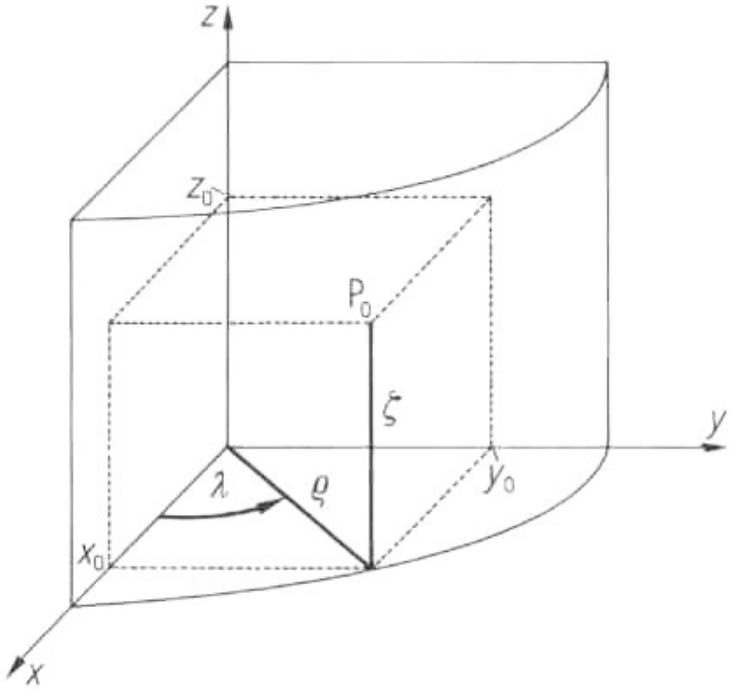
Sphärische und zylindrische Koordinaten (aus Ref. [3])



$$x_0 = r \sin\vartheta \cos\varphi$$
$$y_0 = r \sin\vartheta \sin\varphi$$
$$z_0 = r \cos\vartheta$$

(a)

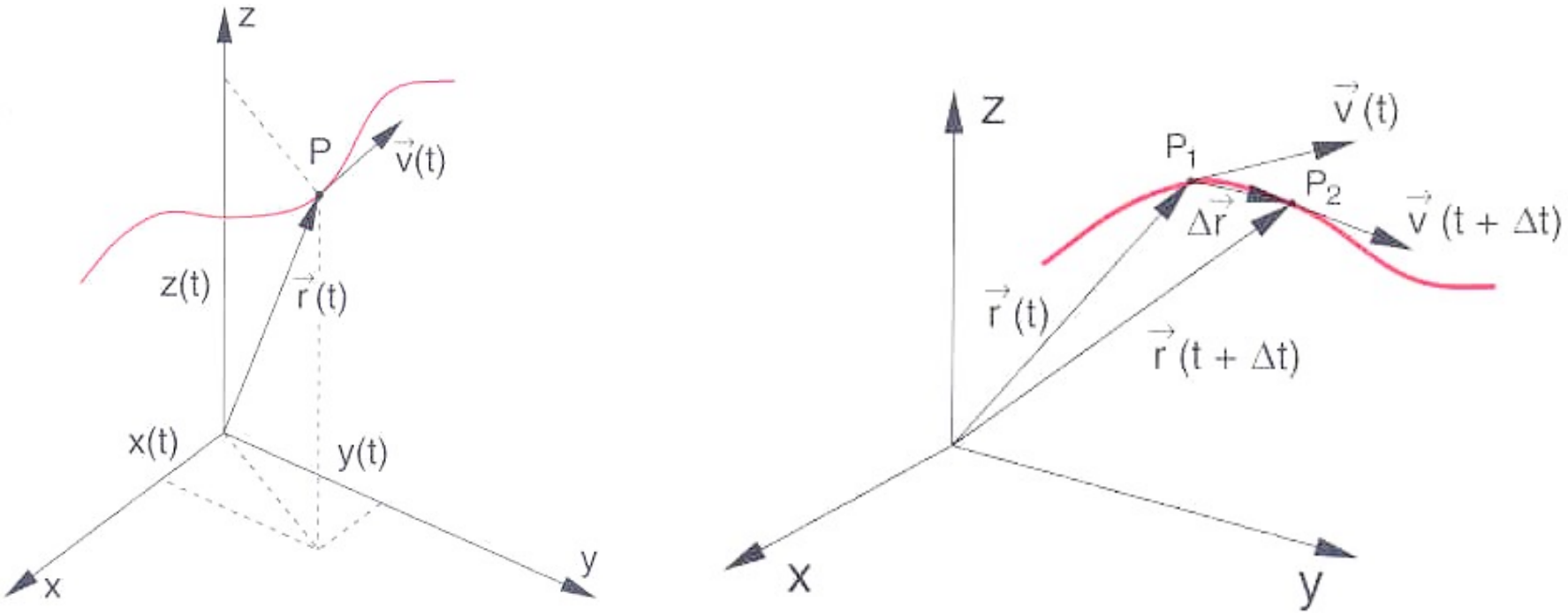
$$r = \sqrt{x_0^2 + y_0^2 + z_0^2}$$
$$\vartheta = \arccos \frac{z_0}{\sqrt{x_0^2 + y_0^2 + z_0^2}}$$
$$\varphi = \arctan \frac{y_0}{x_0}$$



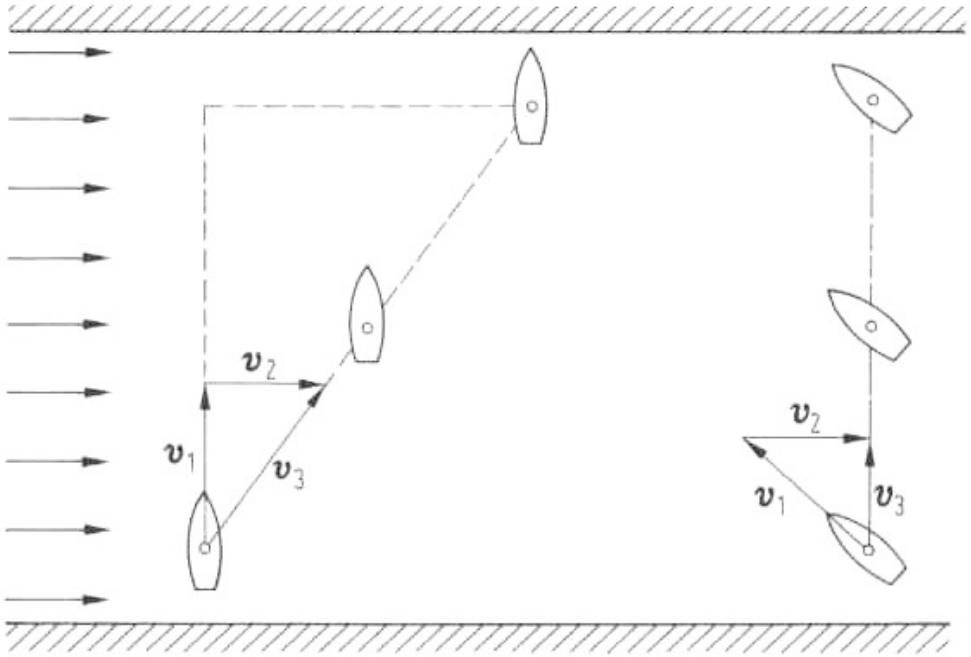
$$x_0 = \varrho \cos\lambda$$
$$y_0 = \varrho \sin\lambda$$
$$z_0 = \zeta$$

(b)

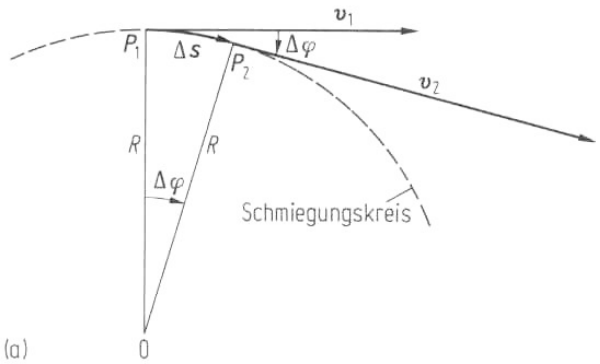
$$\varrho = \sqrt{x_0^2 + y_0^2}$$
$$\lambda = \arccos \frac{x_0}{\sqrt{x_0^2 + y_0^2}}$$
$$\zeta = z_0$$

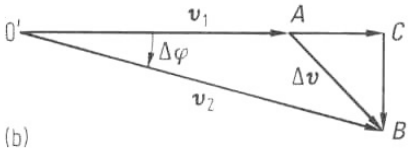


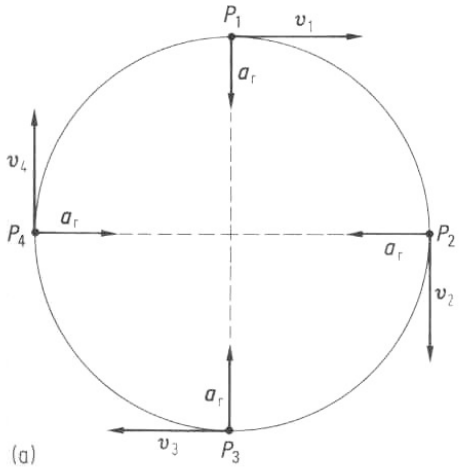
Bahnkurve, Orts- und Geschwindigkeitsvektoren (aus Ref. [1])

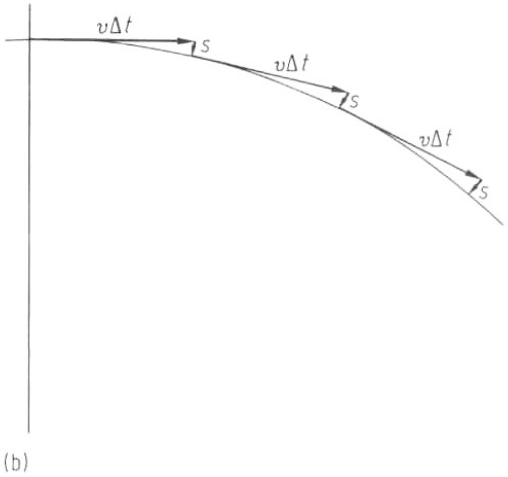


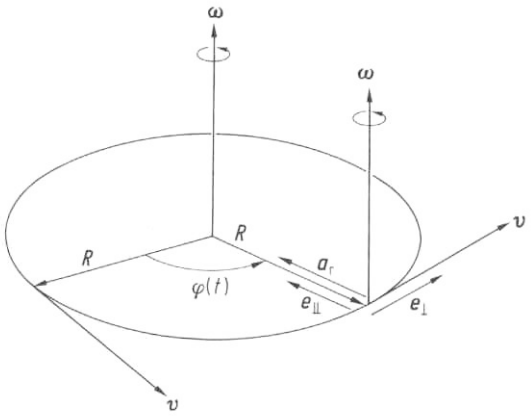
Beispiel zur Addition von Geschwindigkeiten (aus Ref. [3])











Illustrationen zur gleichförmigen Kreisbewegung (aus Ref. [3])