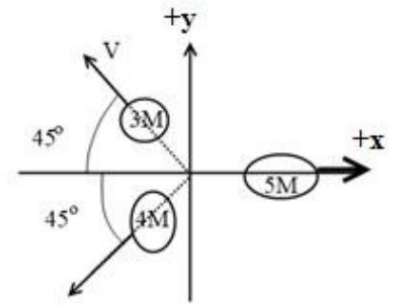


METÓDY RIEŠENIA FYZIKÁLNYCH ÚLOH zima20 – Príklady 2

Cvičenie 15.10.2020

Príklad 1

An object of mass $12M$ is at rest when it suddenly explodes into 3 pieces with masses $3M$, $4M$, and $5M$. The piece of mass $3M$ moves with speed V in the direction shown in the diagram. What is the speed of the piece with mass $5M$ knowing that it is moving directly to the right?



Príklad 2

In unbounded vacuum, the initial electric and magnetic fields are given by

$$\begin{aligned}\mathbf{E}(\mathbf{r}, t = 0) &= \hat{\mathbf{y}} f(x) \\ \mathbf{B}(\mathbf{r}, t = 0) &= 0.\end{aligned}$$

Find $\mathbf{E}(\mathbf{r}, t)$ and $\mathbf{B}(\mathbf{r}, t)$ for $t \geq 0$.

Príklad 3

PROBLEM: A mechanical system consists of two particles, one of which moves in three dimensions, the other of which is confined to a plane. The particle masses are m_1 and m_2 , respectively. The potential energy of the system is

$$U(x, y, z, \rho, \phi) = V(u, v),$$

where

$$u \equiv \alpha x + \beta y + \gamma z, \quad v \equiv y + a\phi.$$

Thus, the potential U depends only on two linear combinations of the five degrees of freedom.

(a) Write down the Lagrangian and the equations of motion.

(b) Noether's theorem says that to each continuous one-parameter family of transformations of the generalized coordinates, there corresponds an associated conserved quantity. For this system, identify all such one-parameter families and conserved quantities.

(c) Is anything else conserved by the dynamics?

Príklad 4

PROBLEM: The index of refraction in the atmosphere of a planet varies according to the law $n(h) = n_0 - \alpha h$, where h is the height and both n_0 and α are constant. Find the height h at which electromagnetic waves propagate along a circular orbit around the planet. The planet's radius is R .