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Vasiliy V. Knysh,

Mathematishian,

Belarus

On second Newton law

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Annotation: We introduce the notion of a non-degenerate function. Thanks to this received Newton's second law of the third order. As well as the equation of motion of a particle in a central field.

1. The function defined on an interval is ***degenerated*** if it is non-invertible on any subinterval of the interval definition. The example of a function degenerated is a constant function.

We assume that the function is non-degenerate. Then there exists at least one subinterval possibly larger where the function is invertible. After exclusion of all such inversion subintervals we have a set.

If it is discontinuous, then the function is called to as ***non-degenerated***, for example sin x.

If it is not discontinuous then the set contains subintervals. On each of them the function is degenerated. We exclude all such subintervals of degeneration. The residue of the set is discontinuous. Then the function is called to as ***half-degenerated***.

Since a half-degenerated (non-degenerated one is its special case) function is a negation of the degenerated one, any function is included in one of the above-mentioned classes.

Thus, a interval definition of non-degenerate function is a sum of subintervals (a theorem on the representation of interval sum subinterval). On each of which a function is strictly monotone. By Lebesgue's theorem on a function subinterval almost everywhere has a finite derivative. Thus we have the fundamental equation

$$f(x)g(y)=1, \quad (1)$$

where f and g are adjoint derivatives of the inverse functions.

Any of these derivatives can not be zero almost everywhere, otherwise its adjoint derivative almost everywhere not finite, which contradicts the theorem of Lebesgue.

2. Let x (t) nondegenerate function with the corresponding derivatives. Then

$$\dot{x} \equiv 1/t_1'(x) \overset{\text{def}}{=} v(x).$$
$$\ddot{x} = v'(x)\dot{x} = v'(x)v(x) = (v^2(x)/2)'_x = (v^2/2)'_x,$$
$$\text{where } v^2 = v^2(x) + v^2(y) + v^2(z).$$

Then we have the identity

$$\ddot{x}\vec{i} + \ddot{y}\vec{j} + \ddot{z}\vec{k} \equiv \left(\frac{v^2}{2}\right)_x \vec{i} + \left(\frac{v^2}{2}\right)_y \vec{j} + \left(\frac{v^2}{2}\right)_z \vec{k}$$

If exist a corresponding function F, we have Newton's second law

$$\ddot{x}\vec{i} + \ddot{y}\vec{j} + \ddot{z}\vec{k} = F_x\vec{i} + F_y\vec{j} + F_z\vec{k}.$$

In this

$$V^2/2 = F + \text{const}.$$

Likewise,

$$\dddot{x}\vec{i} + \dddot{y}\vec{j} + \dddot{z}\vec{k} \equiv \left(\frac{v^2}{2}\right)_{xx} \dot{x}\vec{i} + \left(\frac{v^2}{2}\right)_{yy} \dot{y}\vec{j} + \left(\frac{v^2}{2}\right)_{zz} \dot{z}\vec{k}.$$

If exist a corresponding function F , then Newton's second law of third order can be written as

$$\dddot{x}\vec{i} + \dddot{y}\vec{j} + \dddot{z}\vec{k} = F_{xx}\dot{x}\vec{i} + F_{yy}\dot{y}\vec{j} + F_{zz}\dot{z}\vec{k}.$$

In this,

$$v^2/2 = F + a + bx + cy + dz + exy + hxz + kyz + lxyz$$

(2) other view of conservation energy law.

All the principles of mechanics are between Newton's second law of second and third order?

Galileo's law. If Fxx = Fyy = Fzz = 0, the uniformly accelerated motion. Wherein v ^ 2/2 = a + bx + cy + dz.

Let F = F (r), we differentiate both sides of (2) for x, y, z

$$\frac{\ddot{x} - b - ey - hz - lyz}{x} = \frac{\ddot{y} - c - ex - kz - lxz}{y} = \frac{\ddot{z} - d - hx - ky - lxy}{z} = \frac{F'}{r}$$

3. General view of the gravitational force F(r)

$$\frac{\ddot{x}}{\dot{x}}=F_{xx}=F''\frac{x^2}{r^2}+F'\frac{1}{r}-F'\frac{x^2}{r^3}$$

$$\frac{\ddot{y}}{\dot{y}}=F_{yy}=F''\frac{y^2}{r^2}+F'\frac{1}{r}-F'\frac{y^2}{r^3}$$

$$\frac{\ddot{z}}{\dot{z}}=F_{zz}=F''\frac{z^2}{r^2}+F'\frac{1}{r}-F'\frac{z^2}{r^3}$$

$$F_{xx}+F_{yy}+F_{zz}=F''+2F'/r$$

The right side of this equation is a function of r. The solution of this linear inhomogeneous differential equation gives the general form of the gravitational force F '= const / r ^ 2 + something.

Addition. Likewise calculate the gravitational force not only the three-dimensional space: c / r, c / r ^ 2, c / r ^ 3, ... Is known that the c / r ^ 2 in three dimensions generates closed paths and others is not stable. Maybe that's why our physical world is three-dimensional?

4. F=F(r), we calculate the operator

$$\frac{F_{xxx}}{x}+\frac{F_{yyy}}{y}+\frac{F_{zzz}}{z}=\frac{F'''}{r}+\frac{6F''}{r^2}-\frac{6F'}{r^3}$$

The right side of this equation is a function of r. The solution of this linear inhomogeneous differential equation gives the general form of the gravitational force of the highest order F '= c1r + c2 / r ^ 6. Gravity center of the galaxy?

5. F'(r)=p/r^2, v^2/2=F+const

$$\ddot{x} \equiv \left(v^2/2\right)'_x = F_x = F' r'_x = px/r^3$$

$$\dddot{x} \equiv \left(v^2/2\right)_{xx} \dot{x} = F_{xx}\dot{x} = \left(p/r^3 - 3px^2/r^5\right)\dot{x}$$

Likewise

$$(\ddot{x} - b)/x = p/r^3$$

$$\dddot{x}/\dot{x} = \ddot{x}/x - 3px^2/r^5$$

We rule 1 / r and obtain triune equation parametrically given motion

$$\left(\dddot{x}/\dot{x} - \ddot{x}/x\right)^3 + 27x\ddot{x}^5/p^2 = 0$$

6. F'(r)=p/r^2, v^2/2=F+a+bx+cy+dz

$$\ddot{x} \equiv \left(v^2/2\right)'_x = F_x + b = F' r'_x + b = px/r^3 + b$$

$$\dddot{x} \equiv \left(v^2/2\right)_{xx} \dot{x} = F_{xx}\dot{x} = \left(p/r^3 - 3px^2/r^5\right)\dot{x}$$

Likewise

$$(\ddot{x} - b)/x = p/r^3$$

$$\dddot{x}/\dot{x} = (\ddot{x} - b)/x - 3px^2/r^5$$

We rule 1 / r and obtain triune equation parametrically given motion

$$\left(\dddot{x}/\dot{x} - (\ddot{x} - b)/x\right)^3 + 27x(\ddot{x} - b)^5/p^2 = 0$$

The value (b, c, d) characterize an instantaneous change of power.

7. F'(r)=p/r^2, v^2/2=F+a+bx+cy+dz+exy+hxz+kyz+lxyz

$$\frac{\ddot{x} - b - ey - hz - lyz}{x} = \frac{\ddot{y} - c - ex - kz - lxz}{y} = \frac{\ddot{z} - d - hx - ky - lxy}{z}$$

$$\frac{\dddot{x}}{\dot{x}} + \frac{\dddot{y}}{\dot{y}} + \frac{\dddot{z}}{\dot{z}} = 0$$

This system of three equations for the three unknowns describes the particle motion in the general form.

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