Vedha
Zero to Zenith...

Date : Page :
Topic : project NO - 2

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class - M.Sc (math) secound year
IV semister

PRN NO - 2020015200804031

seat NO - CT0401559

Subject - Mathematics

project paper Name - 2 paper No
MAT - 512

MECHANICS

* Holonomic & Nonholonomic System *

16/NO

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project paper / paper No-2-MAT-[redacted]512

MECHANICS

* Holonomic & Nonholonomic System *

Nonholonomic system :-

A nonholonomic system in physics and mathematics is a physical system whose state depends on the path taken in order to achieve it. such a system is described by a set of parameters subject to differential constraints, such that when the system envolves along a path in its parameter space, but finally returns to the original set of parameter values at the start of the path, the system itself may not have returned to its original state.

Details:-

More precisely, a nonholonomic system, also called an anholonomic system, is one in which there is a continuous closed circuit of the governing parameters, by which the system may be transformed from any given state of the system depends on the intermediate values of its trajectory through parameter space, the system cannot be represented by a conservative potential function as can, for example, the inverse square law of the gravitational force.

Examples:-

When linearly polarized light is again introduced at one end, with the orientation of the polarization aligned with the stripe, it will, in general, emerge as

Date : Page : 3
Topic :

linear polarized light aligned not with the stripe, but at some fixed angle to the stipe, dependent upon the length of the fiber and the pitch and radius of the helix.

Holonomic system:-

In classical mechanics, holonomic constraints are relations between the position variable that can be expressed in the folln form.

$f(u_1, u_2, u_3, \dots, u_n, t) = 0$

where, $\{u_1, u_2, u_3, \dots, u_n\}$ are the n generalized coordinates that describe the system. For example, the motion of a particle constrained to lie on the surface of a sphere is subject to a holonomic constraint, but if the influence of gravity, the constraint

Date : Page : 4
Topic :

becomes non-holonomic. For the first case the holonomic constraint may be given by the eqn.

$$r^2 - a^2 = 0$$

where, r is the distance from the centre of a sphere of radius a, whereas the second non-holonomic case may be given by,

$$r^2 - a^2 \geq 0$$

velocity-dependent constraints such as:
$f(u_1, u_2, \ldots u_n, \dot{u}_1, \dot{u}_2 \ldots \dot{u}_n\ t) = 0$
are not usually holonomic.

Holonomic system:-

In classical mechanics a system may be defined as holonomic if all constraints of the system are holonomic. For a constraint to be holonomic it must be expressible as

Date : Page : 5

Topic :

function.

$$f(u_1, u_2, u_3, \dots, u_n, t) = 0,$$

i.e. a holonomic constraint depends only on the coordinates x_i and may be time t. It does not depend on the velocities or any higher-order derivative with respect to t. A constraint that cannot be expressed in the form shown above is a nonholonomic constraint.

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