DHAKA COLLEGE

Department of Physics

"Assignment"

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CONTENT

"Assignment (PH301)"

Degrees of freedom.

An important characteristic of any mechanical system is the number of degrees of freedom. The number of degrees of freedom is the number of coordinates needed to specify the location of the objects. Therefore, if there are N free objects, there are 3N degrees of freedom. But if there are of degrees of freedom for a system of N Constraint on the objects then each constraint removes one degree of freedom. The total number of degrees of freedom for a system of N objects and n constraints is 3N-n.

As an example, consider 3 free objects. This system has a total of 9 degrees of freedom. If we constrain the separation between the three to be fixed, we loose three degrees of freedom & therefore our system has only 9-3=6 degrees of freedom. These 6 degrees of freedom could be selected using any convenient set. for example the 3 coordinates of the center of mass plus the 3 Euler angles.

Constraints

A constraints on a system is a parameter that the system must obey. For example: a box sliding down a slope must remain on the slope. There are two different types of constraints. They are holonomic & non-holonomics.

Since there are a variety of different types of constraints, we will examine some of the possibilities and how to incorporate them into the Lagrangian or Hamiltonian. The simplest constraints are those that can be put into the following form $g_j(q_i) = 0$

where g_j can be a function of all the generalized coordinates.

Again, All constraints that are not given by $g_j(q_i) = 0$ are called non-holonomic.

"Assignment (PH302)"

Uncertainty Principle

In quantum mechanics, the uncertainty principle is any of a variety of mathamatical inequalities asserting a fundamental limit to the accuracy with which the values for certain pairs of physical quantities of a particle, such as position, x, and momentum, p, can be predicted from initial conditions.

Introduced First in 1927 by the German physicist Werner Heisenberg, the uncertainty principle states that the more precisely the position of some particle is determined, the less precisely its momentum can be predicted from initial conditions, and vice versa. The formal inequality relating the standard deviation of position σ_x and the standard deviation of momentum σ_p was derived by

Earle Hesse Kennard later that year and by Hermann Weyl in 1928.

$$\sigma_x \sigma_p \geq \frac{\hbar}{2}$$

Where $\hbar$ is the reduced Planck constant, $h/2\pi$

The uncertainty principle is alternatively expressed in terms of a particle's momentum and position. The momentum of a particle is equal to the product of its mass times its velocity.

Formula

$$\Delta x \, \Delta p \geq \frac{h}{4\pi}$$

Where,

Δx = Uncertainty in position

Δp = Uncertainty of momentum

h = planek's constant

π = pi

"Assignment (PH303)"

Crystal:

A crystal or crystalline solid is a solid material whose constituents (such as atoms, molecules, or ions) are arranged in a highly ordered microscopic structure, forming a crystal lattice that extends in all directions. In total there are seven crystal systems: triclinic, monoclinic, orthorhombic, tetragonal, trigonal, hexagonal and cubic.

Lattice Structure

Lattice structure are topologically ordered, three-dimensional open-celled structures composed of one or more repeating unit cells. Those cells are defined by the dimentions and convectivity of their constituent strut elements. which are connected at specific nodes. We know are seven crystal ;: triclinic, monoclinic, orthorhombic tetragonal, trigonal, hexagonal & cubic. Some digram - Fig ① Like as Tetragonal.

and Fig(2) like as Orthorhombic Lattice Structure.

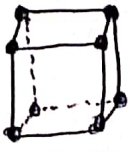
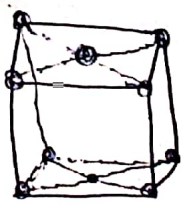


Fig: ①



Fig(2)

"Assignment (PH 304)"

Radio activity and decays:

Radioactive decay is a property of several naturally occurring elements as well as of artificially produced isotopes of the elements. The rate at which a radioactive element decays is expressed in terms of its half-life that is the time required for one-half of any given quantity of the isotope to decay. Radioactivity refers to the particles, which are emitted from a nuclie as a result of nuclear instability. Because the nucleus experiences the intense conflict between the two strongest forces in nature. And the other side Radioactive decay is the process by which an unstable atomic nucleus loses energy by radiation. There are most common type of decay are alpha decay and gamma decay. All of which involve emitting one or more particles or photons.

"Assignment (PH305)"

Maxwells equations:

Maxwells equations are a set of coupled partial differential equations that, together with the Lorentz force law, from the foundation of classical electromagnetism, classical optics and electrics circuits. Maxwell first used the equations to propose that light is an electromagnetic phenomenon. In the modern context, maxwell's equations refer to a set of four relations that describe the properties and interrelations of electric and magnetic fields. They are.

1. $\nabla \cdot D = \rho$ (Gauss law)
2. $\nabla \cdot B = 0$ (Gauss law for magnetism)
3. $\nabla \times E = \frac{\partial B}{\partial t}$ (Faradays' law)
4. $\nabla \times h = \frac{\partial D}{\partial t} + J$ (Ampere – Maxwell law)

"Assignment (PH306)"

Absorption spectra

Atoms do not only emit photons; they also absorb photons. If a photon hits an atom and the energy of the photon is the same as the gap between two electron energy levels in the atom, then the electron in the lower energy level can absorb the photon and jump up to the higher energy level. If the photon energy does not correspond to the difference between two energy levels then the photon will not be absorbed. Using this effect, if we have a source of photons of various energies we can obtain the absorption spectra for different materials. To get an absorption spectrum, just shine white light on a sample of the material that you are interested in. White light is made up of

all the different wavelengths of visible light put g together. In the absorption spectrum there will be gaps. The gaps correspond to energies (wavelengths) for which there is a corresponding difference in energy levels for the particular element.

Emission Line Spectra

An emission line will appear in a spectrum if the source emits specific wavelength of radiation. The emission occurs when an atom, element or molecule in an excited state returns to a configuration energy. The energy is equal to the difference between the higher & lower energy levels.

"Assignment (PH307)"

Necessity of C++

Programming in physic

Programming is extremely important in almost every area of physics. Not every physicist has to be an expert programmer, but many are, and virtually all physicists are at least competent programmeren. In most experiments, the process of data analysis is complex enough to require some programming. Carefully designed C++ programs should therefore be easierc to understand and contain fewerc lines than an equivalent C progream. Before an object can be created a definition of an object is called a class and can be thought of an extended type.

The ancestry of C++ is form hard wired push button logic programming to assembler to C & then C++.

Scientists on the other hand have typically had to work backwards from more maths & equation based Language like FORTRAN to C++ as the It support for FORTRAN dwindled.

C++ is important in physics because of its antecedents and its popularity & its flexibility leaving it as the 'last one standing on the language with widest usage over the widest range of device families.

"Assignment (PH308)"

Optical telescopes

An optical telescopes is a telescope that gathers and focuse light, mainly from the visible part of the electromagnetic spectrum to create a magnified image fore direct view, orc to make a photograph orc to collect data through electronic image sensors.

A tetescopes ability to resolve small detail is directly related to the diameter of its objective & its light gathering powerc is related to the area of the objective. The largerc the objective the more light the telescope collects and the finerc details it resolves.