EIGENVALUES IN SELF DRIVING VEHICLES

AIM OF THE EXPERIMENT:

To find the principle moment of inertia using eigenvalue for calculating force need to accelerate or decelerate self-driving cars.

MATHEMATICAL BACKGROUND:

Moment of inertia is measure of ability of a body to resist change in motion.It depends on the mass distribution of the body.

The moment of inertia of complex systems such as a vehicle or airplane around its vertical axis can be measured by suspending the system from three points to form a trifilar pendulum. A trifilar pendulum is a platform supported by three wires designed to oscillate in torsion around its vertical centroidal axis. The period of oscillation of the trifilar pendulum yields the moment of inertia of the system.

Let the moments of inertia between the axes be Ixx,Ixy,Ixz,Iyy,Iyz,Izz.

To find the principle moments of inertia we need to find the eigenvalues of the matrix

$$\begin{matrix} I_{xx} & -I_{xy} & -I_{xz} \\ -I_{xy} & I_{yy} & -I_{yz} \\ -I_{xz} & -I_{yz} & I_{zz} \end{matrix}$$

i.e solving

$$\begin{vmatrix} I_{xx}-\lambda & -I_{xy} & -I_{xz} \\ -I_{xy} & I_{yy}-\lambda & -I_{yz} \\ -I_{xz} & -I_{yz} & I_{zz}-\lambda \end{vmatrix} = 0$$

Gives the principal moments of inertia

MATLAB CODE:

```
clc
clear all
a=[ ];
disp("enter moment of inertia");
for i=1:3
    b=[ ];
    for j=1:3
        x=input("enter matrix element");
        b=[b x];
    end
    a=[a;b];
end
disp(a)
eig(a)
```

OUTPUT:

```
enter moment of inertia

enter matrix element1
```

```
enter matrix element2

enter matrix element3

enter matrix element4

enter matrix element5

enter matrix element6

enter matrix element7

enter matrix element8

enter matrix element9

   1   2   3

   4   5   6

   7   8   9

ans =



   1.6117e+01

  -
1.1168e+00

  -1.3037e-15
```

ENGINEERING INTERPRETATION:

Itsa quantity that characterizes the mass distribution of a body and that is, together with the mass, a measure of the inertia of the body duringnontranslational motion. In mechanics a distinction is made between (1) axial moments of inertia and (2) products of inertia. The quantitydefined by the equation

$$(1) \qquad I_z = \sum m_i h_i^2 \quad \text{or} \quad \int_V \rho h^2 \, dV$$

is called the principal moment of inertia of the body with respect to the z-axis; in this equation, the w, are the masses of the points of the body,the mi are

the distances of the points from the zaxis, ρ is the mass density, and V is the volume of the body. The quantity Iz is a measure ofthe body's inertia when the body rotates about the axis.

The eigenvalue concept is applied to artificial intelligence systems life self-driving cars,self-driving aircrafts etc. where it is necessary to calculate the moments of inertia to find the necessary force required.Though it is more related to physics,this concept is also a part of artificial intelligence system design.Such AI machines uses this concept of eigenvalue to determine its next move.

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