



that the $D_{1,1}$ is a 7×7 matrix that is

$$D_{1,1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

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1. Introduction

$$D_{1,1} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

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(a) $(a, 0, 0)$, $(0, a, 0)$, $(0, 0, a)$ are the vertices of a cube of side length a in the first octant of a Cartesian coordinate system with origin at the center of the cube. The cube is centered at the origin $(0, 0, 0)$.

The cube is oriented such that its edges are parallel to the axes. The vertices are at $(\pm a/2, \pm a/2, \pm a/2)$.

The distance from the origin to any vertex is $\sqrt{3}a/2$.

The volume of the cube is $V = a^3$.

The surface area of the cube is $A = 6a^2$.

The moment of inertia of the cube about the x -axis is $I_x = \frac{3}{8}ma^2$.

The moment of inertia of the cube about the y -axis is $I_y = \frac{3}{8}ma^2$.

The moment of inertia of the cube about the z -axis is $I_z = \frac{3}{8}ma^2$.

The moment of inertia of the cube about a diagonal is $I_d = \frac{3}{10}ma^2$.

The moment of inertia of the cube about a line parallel to the x -axis and passing through the center of the cube is $I_x = \frac{3}{8}ma^2$.

The moment of inertia of the cube about a line parallel to the y -axis and passing through the center of the cube is $I_y = \frac{3}{8}ma^2$.

The moment of inertia of the cube about a line parallel to the z -axis and passing through the center of the cube is $I_z = \frac{3}{8}ma^2$.

The moment of inertia of the cube about a line parallel to the x -axis and passing through one of the vertices is $I_x = \frac{3}{8}ma^2$.

The moment of inertia of the cube about a line parallel to the y -axis and passing through one of the vertices is $I_y = \frac{3}{8}ma^2$.

The moment of inertia of the cube about a line parallel to the z -axis and passing through one of the vertices is $I_z = \frac{3}{8}ma^2$.

The moment of inertia of the cube about a line parallel to the x -axis and passing through the center of the cube and one of the vertices is $I_x = \frac{3}{8}ma^2$.

The moment of inertia of the cube about a line parallel to the y -axis and passing through the center of the cube and one of the vertices is $I_y = \frac{3}{8}ma^2$.

The moment of inertia of the cube about a line parallel to the z -axis and passing through the center of the cube and one of the vertices is $I_z = \frac{3}{8}ma^2$.

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Let α be a root of $f(x)$ in \mathbb{C} . Then α is a root of $f(x)$ in \mathbb{R} if and only if α is real. If α is not real, then $\bar{\alpha}$ is also a root of $f(x)$ in \mathbb{C} . Since $f(x)$ has real coefficients, the complex roots occur in conjugate pairs. Therefore, the roots of $f(x)$ in \mathbb{R} are the real roots of $f(x)$ in \mathbb{C} .



Fig. 7. (a) Plot of $\log_{10}(\text{amplitude})$ vs. $\log_{10}(\text{frequency})$ for a system with $\tau = 0.1$ s. (b) Plot of $\log_{10}(\text{amplitude})$ vs. $\log_{10}(\text{frequency})$ for a system with $\tau = 0.01$ s. The plots show the magnitude response of the system, with the x-axis representing frequency in Hz and the y-axis representing the magnitude in dB. The curves show a characteristic roll-off at high frequencies, with the roll-off rate being steeper for the smaller time constant $\tau = 0.01$ s.



Fig. 8. (a) Plot of $\log_{10}(\text{amplitude})$ vs. $\log_{10}(\text{frequency})$ for a system with $\tau = 0.1$ s. (b) Plot of $\log_{10}(\text{amplitude})$ vs. $\log_{10}(\text{frequency})$ for a system with $\tau = 0.01$ s. The plots show the magnitude response of the system, with the x-axis representing frequency in Hz and the y-axis representing the magnitude in dB. The curves show a characteristic roll-off at high frequencies, with the roll-off rate being steeper for the smaller time constant $\tau = 0.01$ s.

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for $(a, a) \in \mathcal{A}$ and $(a, a) \in \mathcal{B}$, $(a, a) \in \mathcal{A} \cap \mathcal{B}$.
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