Exercise: Setting Up an Optical System

Problem sets for setting up an optical system.

WE'LL COVER THE FOLLOWING

Now that we have learned about Jones calculus, we need to find an input light Jones vector for our desired output Jones vector. Let's solve this problem step by step.

Task 1

We know the following information about the system:

There are a total of 6 components placed in the order of their subscripts: C_1, C_2, C_3, C_4 C_5, C_6.

$$C_1 = \begin{bmatrix} 1 & -1 \\ 1 & 0 \end{bmatrix} C_2 = \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix} C_3 = \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}$$

$$C_4 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} C_5 = \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix} C_6 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

Problem statement

Find the System Matrix of the optical components given above.

Use all the suitable packages that you have learned throughout the

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```
# write your code here
```

Task 2

The eigenvectors of the system matrix are significant because, when they are multiplied by the system matrix, the output is a scalar (eigenvalue) multiplied by the eigenvector.

$$\lambda \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$$

where,

- $\begin{bmatrix} x \\ y \end{bmatrix}$ is the eigenvector,
- $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is the system matrix,
- and λ is the eigenvalue.

By using the eigenvectors of the system matrix, we can ensure that the input light and output light have the same polarization.

Problem statement

Find the eigenvectors and eigenvalues of the system matrix.

💡 Use all the suitable packages that you have learned throughout the course.

```
# write your code here
```

Task 3

Now let's find a suitable input light polarization.

Problem statement

Find the suitable input light Jones vector to get the following output vector:

$$\begin{bmatrix} -1 \\ 1 \end{bmatrix}$$

> 💡 Use all the suitable packages that you have learned throughout the course.

```
# write your code here
```

Solutions to these tasks will be discussed in the next lesson.