CS8092

Computer Graphics & Multimedia

Illumination & Color Models

Syllabus

Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model - YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection. Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.

What is computer graphics?

Graphics are defined as any sketch or a drawing or a special network that pictorially represents some meaningful information. Computer Graphics is used where a set of images needs to be manipulated or the creation of the image in the form of pixels and is drawn on the computer.

Computer Graphics can be used in digital photography, film, entertainment, electronic gadgets, UI design, rendering, geometric objects, animation and all other core technologies which are required.

Computer Graphics refers to several things:

- The manipulation and the representation of the image or the data in a graphical manner.
- Various technology is required for the creation and manipulation.
- Digital synthesis and its manipulation.

Types of Computer Graphics

Raster Graphics:

In raster, graphics pixels are used for an image to be drawn. It is also known as a bitmap image in which a sequence of images is into smaller pixels. Basically, a bitmap indicates a large number of pixels together.

Vector Graphics:

In vector graphics, mathematical formulae are used to draw different types of shapes, lines, objects

Applications

- **Computer Graphics are used for** an **aided design for engineering and architectural system-** These are used in electrical automobiles, electro-mechanical, mechanical, electronic devices. For example gears and bolts.
- **Computer Art –** MS Paint.
- **Presentation Graphics –** It is used to summarize financial statistical scientific or economic data. For example- Bar chart, Line chart.
- **Entertainment-** It is used in motion pictures, music videos, television gaming.
- **Education and training-** It is used to understand the operations of complex systems. It is also used for specialized system such for framing for captains, pilots.
- **Visualization-** To study trends and patterns.For example- Analyzing satellite photo of earth.

Light sources

Point source

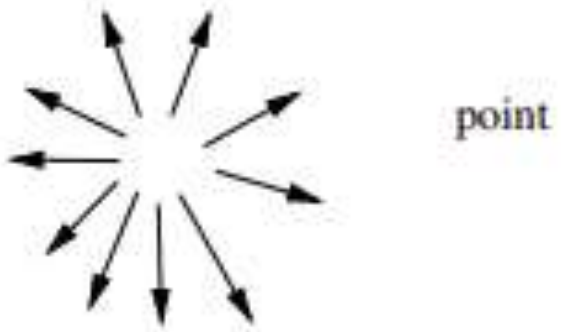
Parallel Source

Distributed Source

Point Sources :

The source that emit rays in all directions (A bulb in a room). The light is inside the scene at a specific location and it shines light equally in all directions. An example is be a table lamp.

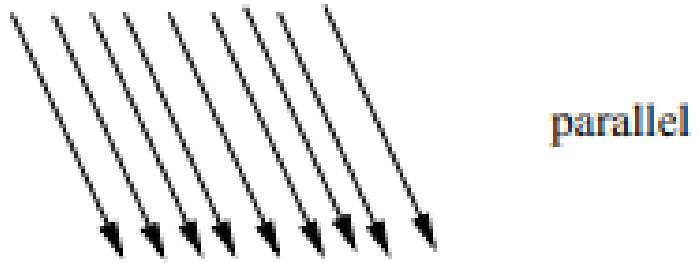
Point light sources are modeled using a single location, (x,y,z,1).



Parallel Sources :

The light is outside the scene and far enough away that all rays of light are basically from the same direction. An example is the sun in an outdoor scene.

Sun light sources are modeled as a single vector, <dx, dy, dz, 0> which defines the direction of the light rays. (The sun).



Distributed Sources:

Rays originate from a finite area (A tubelight).

Basic Illumination Models

What is Illumination?

Light or the place where a light comes from.

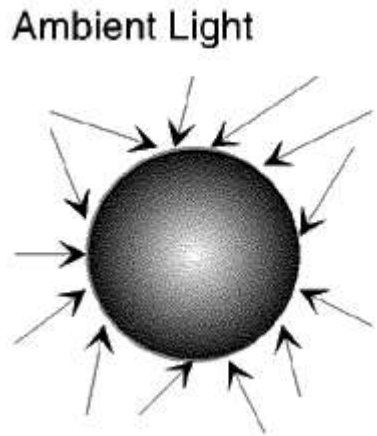
Characteristics of Illumination

- Ambient
- Diffuse and
- Specular

Ambient Illumination

Ambient light is directionless, it interacts uniformly across all surfaces, with its intensity determined by the strength of the ambient light sources and the properties of objects' surface materials

- Light from the environment.
- Light reflected or scattered from other objects.
- Coming uniformly from all directions and then reflected equally to all directions

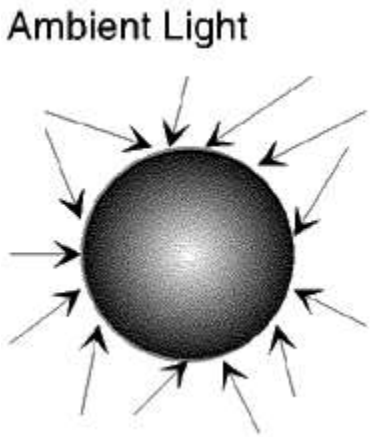


$I_{amb} = K_a I_a$

Where,

I_a = Ambient Light Intensity

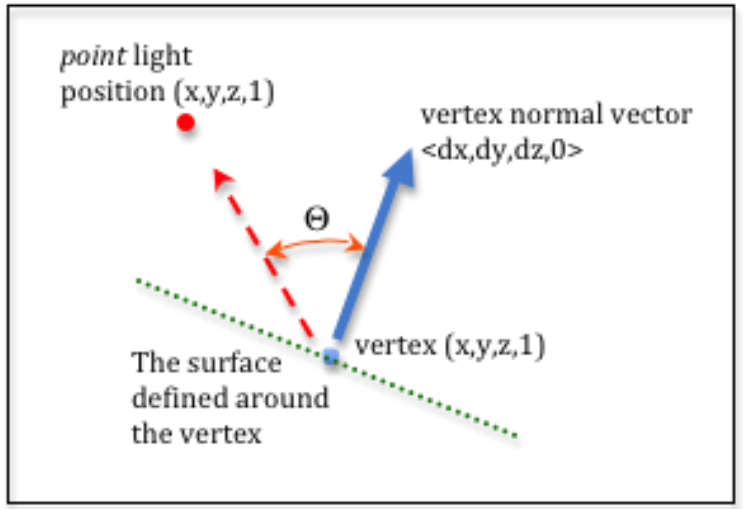
K_a =Surface ambient reflectivity, value of K_a tends from 0 to 1

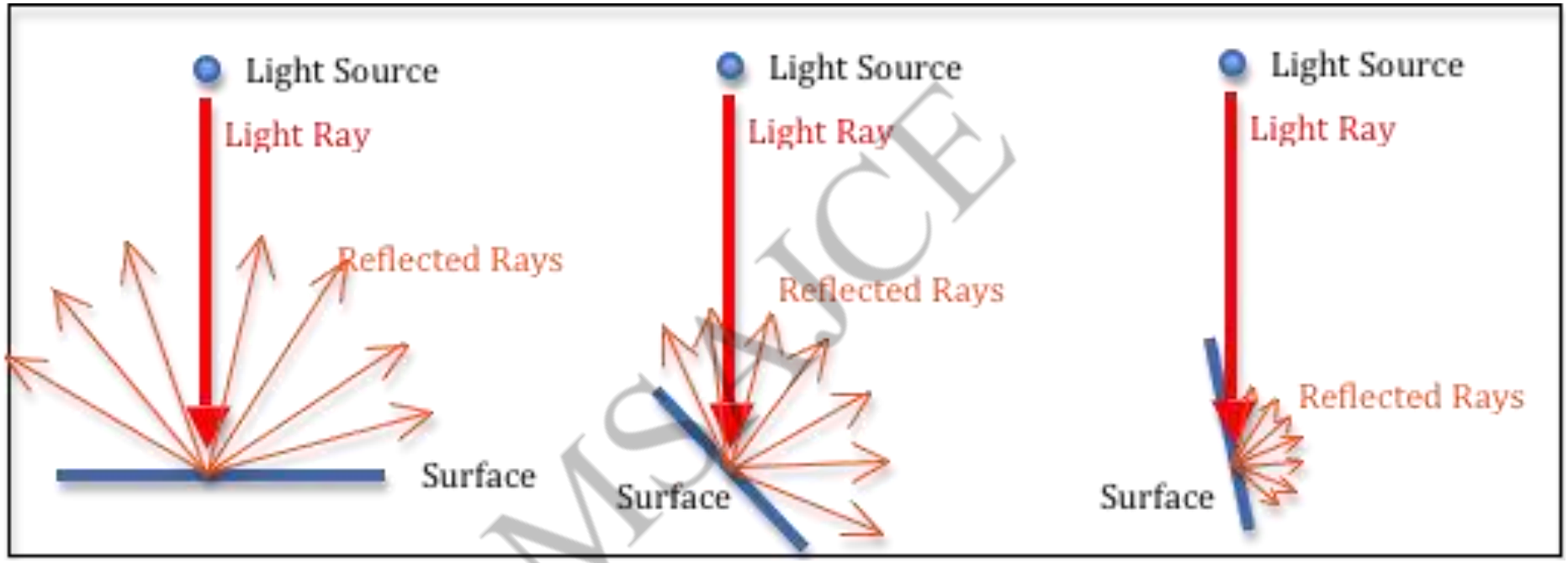


Diffuse Illumination

Diffuse light comes from one direction, so it's brighter if it comes squarely down on a surface than if it barely glances off the surface.

Diffuse lighting (or diffuse reflection) is the direct illumination of an object by an even amount of light interacting with a light-scattering surface. After light strikes an object, it is reflected as a function of the surface properties of the object as well as the angle of incoming light.




Light Source
Light Ray
Reflected Rays
Surface
Light Source
Light Ray
Reflected Rays
Surface
Light Source
Light Ray
Reflected Rays
Surface

$I_{diff} = Cos(theta) K_d I_d$

Where,

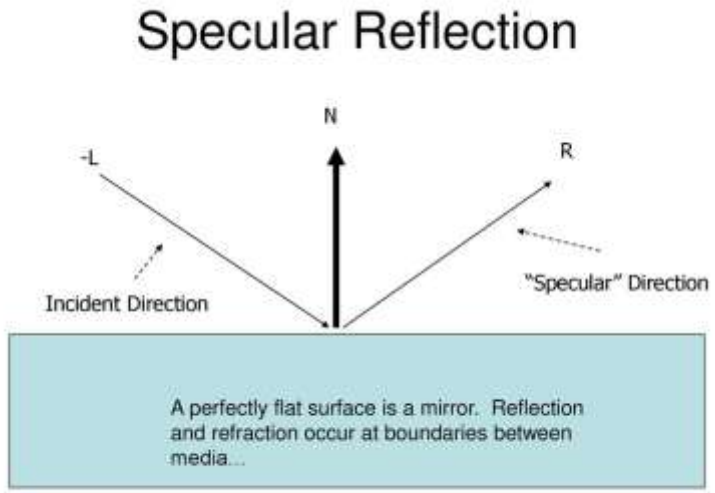
I_d = Intensity of Light

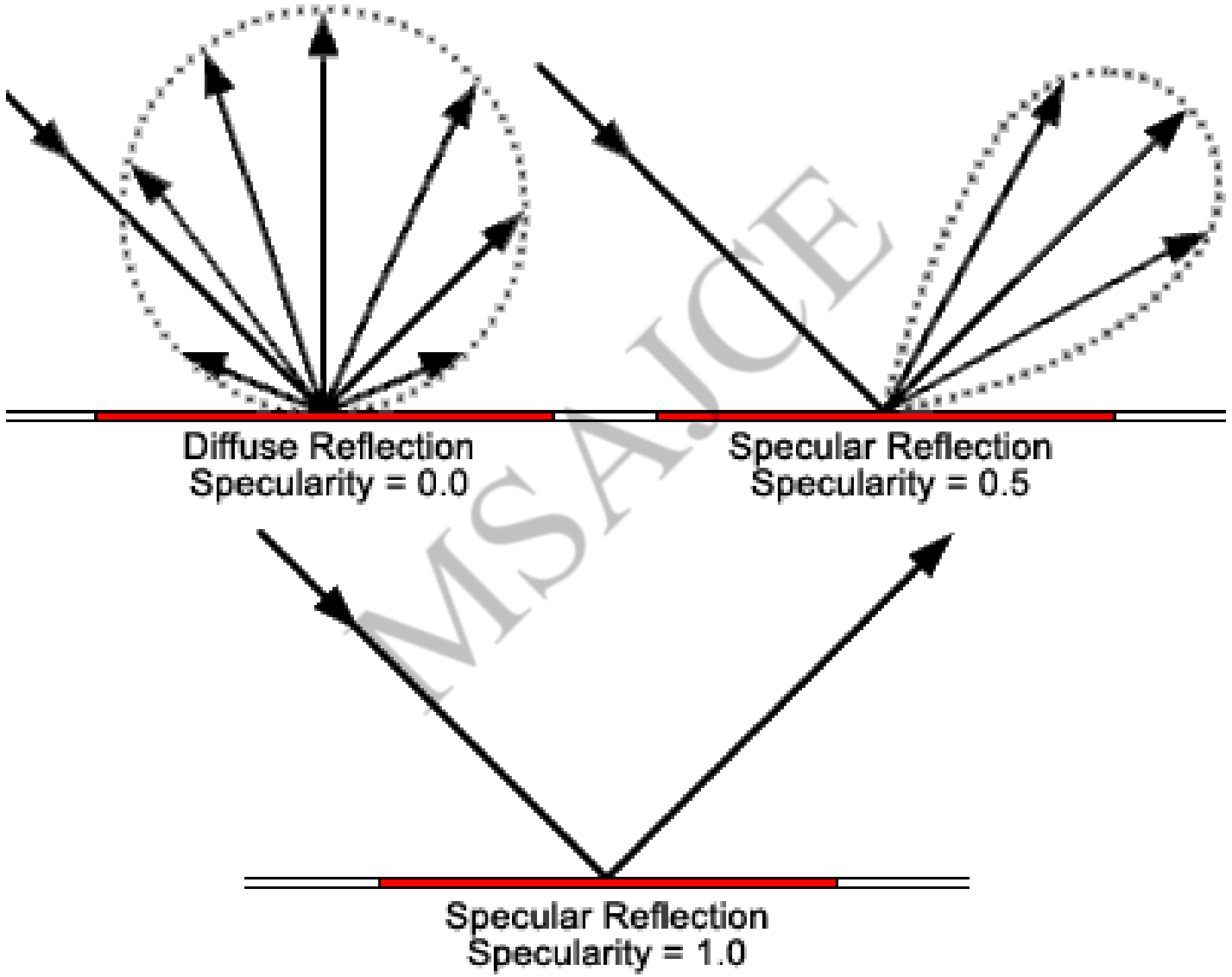
K_a =Coefficient of diffuse reflection

cos – angle of reflection

Specular Illumination

Specular light comes from a **particular direction**, and it tends to bounce off the surface in a preferred direction. A well-collimated laser beam bouncing off a high-quality mirror produces almost 100 percent specular reflection. Shiny metal or plastic has a high specular component, and chalk or carpet has almost none. You can think of specularity as shininess




Diffuse Reflection
Specularity = 0.0
Specular Reflection
Specularity = 0.5
Specular Reflection
Specularity = 1.0