Irradiance Field Calculation:

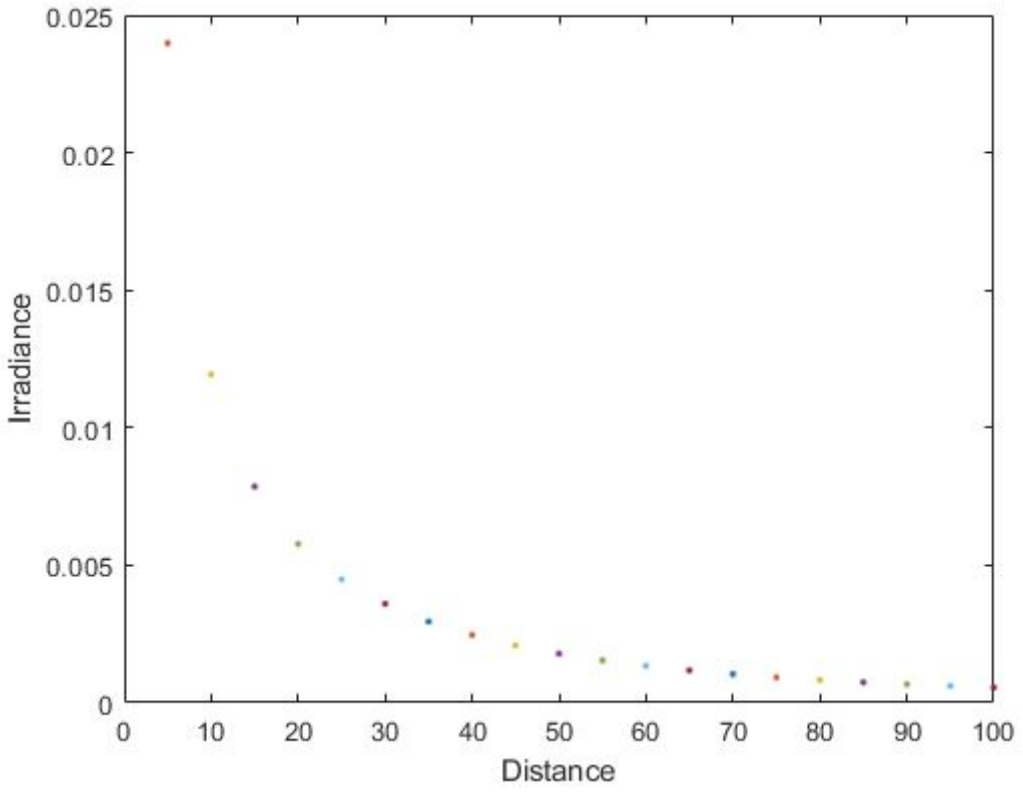
- The complete 3D irradiance field for any UVGI robot need to be resolved in order to establish the dose received by any airborne microbe passing through the field.
- We will be using Soft Glass for the UV Lamp as it will not allow the transmission of UVC wavelengths below 200nm and therefore can not be used to produce ozone at 185nm.
- Considerable advances in internal glass coatings have extended the life time of soft glass lamps to 9,000hrs with 80% UVC output maintenance.
- OZONE Free Lamp: For simple disinfection applications only 254nm line is required. 254nm line can also used for ozone destruction.
- Benefits of disinfection with UVC:
    - It acts immediately
    - Operating cost reduced
    - Environmental Friendly
    - Specific needs can be easily adapted reducing problems.
- Viruses show UV susceptibilities that range from very susceptible to very resistant. Hence, it is very important to identify the intensity of the UV lamp on a particular surface located at a certain distance.

Virus	Type	Water		Surface		Air - Lo RH		Air Hi RH	
		D_{90} J/m^2	UVGI k m^2/J	D_{90} J/m^2	UVGI k m^2/J	D_{90} J/m^2	UVGI k m^2/J	D_{90} J/m^2	UVGI k m^2/J
Adenovirus	dsDNA	903	0.00255			49	0.04700	34	0.06800
Adenovirus type 1	dsDNA	322	0.00714						
Adenovirus type 15	dsDNA	396	0.00581						
Adenovirus type 2	dsDNA	324	0.00711	400	0.00576				
Adenovirus type 4	dsDNA	921	0.00250						
Adenovirus type 40	dsDNA	546	0.00422	300	0.00768				
Adenovirus type 41	dsDNA	515	0.00447	236	0.00976				
Adenovirus type 5	dsDNA	522	0.00441						
Adenovirus type 6	dsDNA	395	0.00583						
Avian Influenza virus	ssRNA	25	0.09140						
Avian Leukosis virus (RSA)	ssRNA	631	0.00365						
Avian Sarcoma virus	ssDNA	220	0.01047						
B. subtilis phage 029	dsDNA	70	0.03289						
B. subtilis phage SP02c12	dsDNA	100	0.02303						
B. subtilis phage SPP1	dsDNA	195	0.01181						
Bacteriophage B40-8	dsDNA	137	0.01679						
Bacteriophage F-specific	dsRNA	292	0.00789						
Bacteriophage MS2	ssRNA	182	0.01268			5	0.42400	7	0.34400
Bacteriophage Qβ	ssRNA	235	0.00980						
Berne virus	ssRNA	13	0.18420						
BLV	ssRNA	394	0.00684						
Borna virus	ssRNA	79	0.02920						
Bovine Calicivirus	ssDNA	95	0.02420						
Bovine Parvovirus	ssDNA	35	0.06580						
Canine Calicivirus	ssRNA	67	0.03450						
Canine hepatic Adenovirus	dsDNA	265	0.00869						
Cholera phage Kappa	dsDNA	634	0.00363						
Coliphage f2	ssRNA	310	0.00743						
Coliphage fd	ssDNA	23	0.09940						
Coliphage ϕX-174	ssDNA	25	0.09292			3	0.71000	4	0.53000
Coliphage lambda	dsDNA	78	0.02953						
Coliphage PRD1	dsDNA	20	0.11500	87	0.02650				
Coliphage T1	dsDNA	14	0.16257						
Coliphage T2	dsDNA	9	0.25243						
Coliphage T3	dsDNA	10	0.23100						
Coliphage T4	dsDNA	13	0.17575						
Coliphage T7	dsDNA	28	0.08152			7	0.33000	10	0.22000
Coronavirus	ssRNA	21	0.11059			6	0.37700		

- Hence it is important to calculate the irradiance field of the robot.
- The irradiance field is calculated using the Inverse square Law model. It states that the irradiance is inversely proportional to the distance from the source.
- We also use the model based thermal radiation view factor which defines the amount of diffuse radiation transmitted from one surface to another.

- The simulation of the same is done in Matlab as shown below.

```
for x=0:5:100 %%distance from the lamp in cm
    l=39.8; %%length of the lamp segment in cm
    r=0.8; %% radius of the lamp in cm
    H=x/r;
    L=l/r;
    X=(1+H)^2+L^2;
    Y=(1-H)^2+L^2;
    M= sqrt((H-1)/(H+1));
    Q=(atan(L/(sqrt(H^2-1))))/L;
    W=atan(M);
    E=((X-(2*H))*atan(M*sqrt(X/Y)))/(sqrt(X*Y));
    F=(L/(pi*H))*(Q-W+E);
    Euv=60; %%UV power output of the lamp
    I=(Euv*F)/(2*pi*r*l);
    plot(x,I,'.');
    ylabel('Irradiance')
    xlabel('Distance')
    hold on
    end
```



Published with MATLAB® R2020a