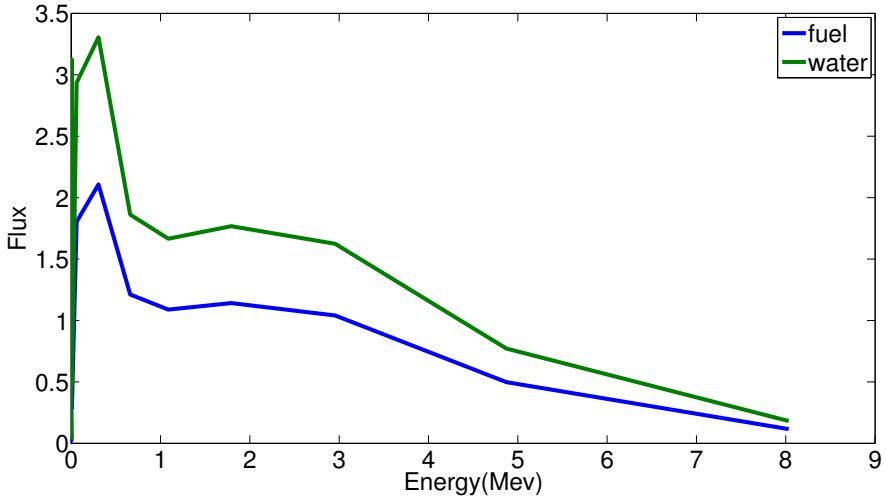


Figure 1: Neutron energy spectrum in fuel and in water

PROBLEM 2.C

a)

$k_{eff} = 1.51595E+00 \pm 0.00184$

b)

The average neutron flux in the fuel is $1.46362E+1 \pm 0.00177$, in the clad is 4.71467 ± 0.00221, in the moderator is $2.39584E01 \pm 0.00144$.

c)

The average absorption rate is 3.82027 ± 0.00746 and the average fission rates in the fuel is 41.89417 ± 0.00172

d)

The neutron spectrum in 23 energy groups in fuel and modrator is plotted as in figure 1. The neutron population is dominately in the thermal region. It drops rapidely in high energy region. From the two energy group results, we observe that the fast neutron flux is only 1/10 of the thermal neutron flux.

The two group flux in fuel is

$$\phi_1 = 1.40452 \pm 0.00196$$
$$\phi_2 = 13.1956 \pm 0.00173$$

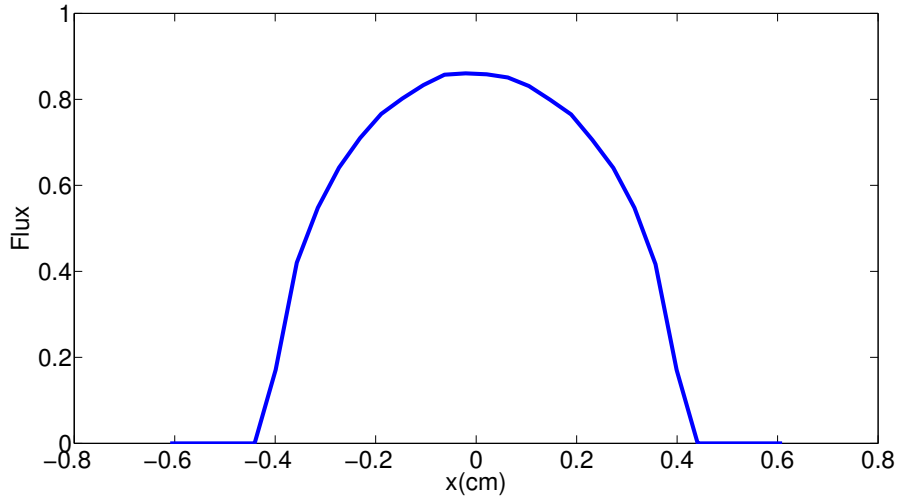


Figure 2: Energy group I neutron flux distribution in fuel

The two group flux in water is

$$\phi_1 = 2.69865 \pm 0.00252$$
$$\phi_2 = 21.2514 \pm 0.00163$$

e)

Spacial distribution of a two-group flux along the central line of the fuel pin is plotted in figure 2 and in figure 3. Additional sparial subdivision is needed for the code to output the averaged flux in each mesh volume instead of averaging the flux in the whole fuel cell volume.

The flux peaks at the center where the neutron leakage is limited.

PROBLEM 3

Defining a lattice constituent with 17 x 17 fuel pins with a pitch of 1.26 cm.

$k_{inf}(analog) = 1.40305 \pm 0.00072$ $k_{inf}(implicit) = 1.40279 \pm 0.00036$

The difference of k_{inf} between a single pin and a 17x17 fuel pin assembly is not significant, because a single pin with reflective boundary condition is an infinite pin lattice.

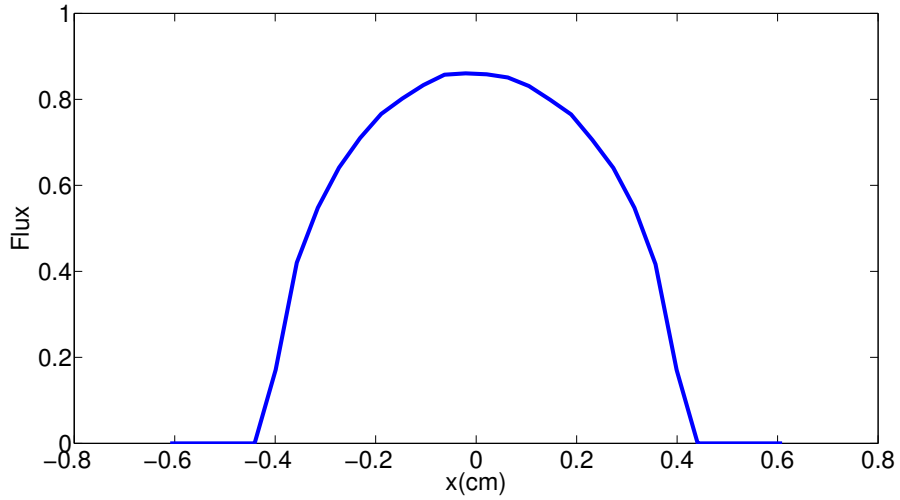


Figure 3: Energy group I neutron flux distribution in fuel

PROBLEM 4

The result k_{inf} for different moderator-to-fuel ratio is listed in table and plotted in figure 4

pitch	mod-fuel-ratio	k_{inf}
1.1	0.67	1.24610 +/- 0.00135
1.26	1.19	1.37914 +/- 0.00130
1.4	1.71	1.44844 +/- 0.00120
1.6	2.53	1.49431 +/- 0.00110
1.8	3.47	1.50903 +/- 0.00094
2	4.53	1.51017 +/- 0.00094

PROBLEM 5

a)

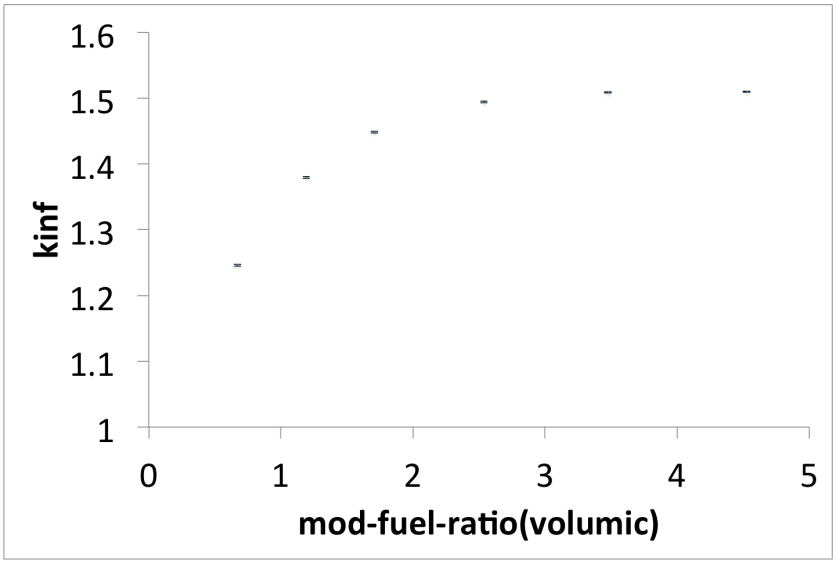
$k_{eff} = 0.99878 \pm 0.00190$

b)

The average neutron flux in the plutonium sphere is 4.69273 ± 0.00195.

c)

Figure 4: kinf vs moderator to fuel ratio



The average absorption rate is $1.06306E-2 \pm 0.00540$. And the average fission rates in the plutonium sphere is $3.17105E-1 \pm 0.00189$

d)

The neutron spectrum is plotted in figure 5. The energy spectrum in the Jezabel reactor is faster than the PWR energy spectrum.

Two groups spectrum is $0+0$ for group 1 and $4.64096E+000.00218$ for group 2

e)

The flux distribution along the central line of the sphere is plotted in figure **??**. Only energy group 2 flux is plotted because group 1 flux is 0.

The distribution is very flat.

Figure 5: energy spectrum

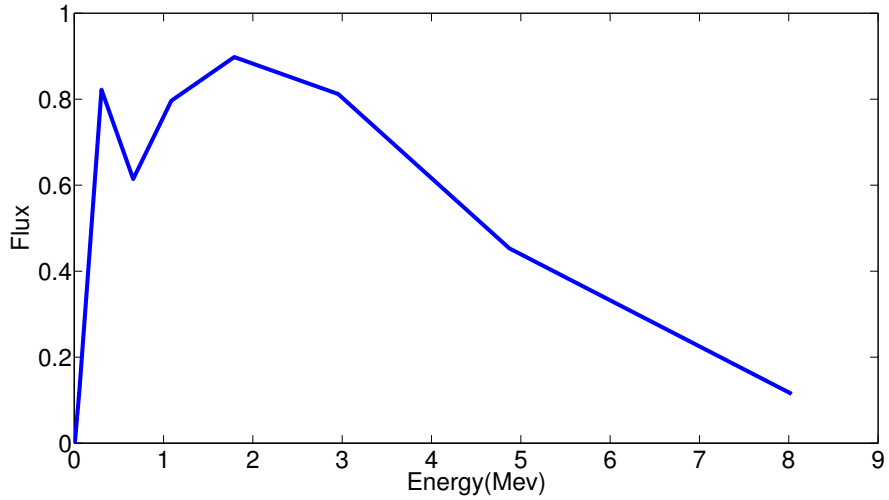


Figure 6: Neutron flux distribution along the central line of the sphere(Energy group 1)