Exercises: Point kinetics

1. Use the m-file pointk.m and ode45 to simulate the response for 60 seconds when the excess reactivity is 80 pcm.

Hints:

a) Set al=log(2)/8;beta=0.00600;L=1.6825e-5;

b) Define the initial condition y0=[1;beta./al/L]

c) Use ode15s :

```
>> [t,y]=ode15s(@pointk,[0 60],y0);
```

2. Note that the system is linear if raa is constant. Define the A-matrix for raa=80 pcm and calculate the eigenvalues. Use the positive eigenvalue to evaluate the doubling time.

Hint: $A = \begin{bmatrix} \frac{\rho-\beta}{L} & \lambda \\ \frac{\beta}{L} & -\lambda \end{bmatrix}$

3. In the same plot as you have plotted y(:,1), plot the response corresponding to the positive eigenvalue (y=y0*exp(t*p), where p is the positive eigenvalue).

a) Why are the curves different?

b) Include the impact of the prompt jump, find a good value from the plot and plot again with the new $y_0 \neq 1$ that takes into account the impact of the prompt jump.

4. Use the function dub2raa to plot the doubling time as a function of reactivity for τ_2=10 to τ_2=100 s.

5. Use the function inv_kinetics to calculate the reactivity and the precursors from n

a) For the simulated signal in exercise 1 and with default values in inv_kinetics:

```
[t,y]=ode15s(@pointk,[0 60],[1;beta/L/al]);
[t1,rho,conc]=inv_kinetics(t,y(:,1));
plot(t1,rho)
```

b) For the simulated signal in exercise 1 with the actual values:

```
[t1,rho1,conc1]=inv_kinetics(t,y(:,1),beta,al);
plot(t1,rho1)
```

c) Compare conc1 with y(:,2).

```
plot(t1,conc1)
hold on
plot(t,y(:,2))
```