ESSC 4520
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L10 Exercise

Ex1

The production term of each species ($P_{C,i,B,m}$):

O_3: $P_{C,O3,B,m} = k_1[O]_{B,m}$
NO_2: $P_{C,NO2,B,m} = k_2[NO]_{B,m}[O_3]_{B,m}$
NO: $P_{C,NO,B,m} = J[NO_2]_{B,m}$
$O(^3P)$: $P_{C,O,B,m} = J[NO_2]_{B,m}$

The loss terms of each species ($L_{C,i,B,m}$):

O_3: $L_{C,O3,B,m} = k_2[NO]_{B,m}[O_3]_{B,m+1}$
NO_2: $L_{C,NO2,B,m} = J[NO_2]_{B,m+1}$
NO: $L_{C,NO,B,m} = k_2[NO]_{B,m+1}[O_3]_{B,m}$
$O(^3P)$: $L_{C,O,B,m} = k_1[O]_{B,m+1}$

The backward Euler formular:

$$N_{i,B,m+1} = \frac{N_{i,t-h} + hP_{C,i,B,m}}{1 + V_{C,i,B,m}}$$

While the $V_{C,i,B,m}$ of each species:

O_3: $L_{C,O3,B,m} = k_2[NO]_{B,m}$
NO_2: $L_{C,NO2,B,m} = J$
NO: $L_{C,NO,B,m} = k_2[O_3]_{B,m}$
$O(^3P)$: $L_{C,O,B,m} = k_1$

The forward Euler formular:

$$N_{i,F,m+1} = N_{i,t-h} + h\left(P_{C,i,B,m} - L_{C,i,B,m}\right)$$

Taking Np = 200, the result will be