$A_p := 0.2$ $P_{atm} := 1$ $L := 0.04$ $V := 2$ $W_s := 0.300$

$O_{2o} := 21.0$ $V_{m1} := 22.71$ $K_{m1} := 7.63$ $K_{i1} := 14.42$ $P_{O2} := 0.2$

$CO_{2o} := 0.03$ $V_{m2} := 17.64$ $K_{m2} := 5.08$ $K_{i2} := 11.99$ $P_{CO2} := 0.2$

$$D(t, oco) := \left| \begin{array}{l} \begin{bmatrix} O_{2i} \\ CO_{2i} \end{bmatrix} := oco \\ r_{O2} := \dfrac{V_{m1} \cdot O_{2i}}{K_{m1} + \left(1 + \dfrac{CO_{2i}}{K_{i1}}\right) \cdot O_{2i}} \\ r_{CO2} := \dfrac{V_{m2} \cdot O_{2i}}{K_{m2} + \left(1 + \dfrac{CO_{2i}}{K_{i2}}\right) \cdot O_{2i}} \\ \dfrac{100}{V} \cdot \begin{bmatrix} \dfrac{A_p \cdot P_{O2} \cdot P_{atm}}{L} \cdot \left(0.01 \cdot \left(O_{2o} - O_{2i}\right)\right) - W_s \cdot r_{O2} \\ \dfrac{A_p \cdot P_{CO2} \cdot P_{atm}}{L} \cdot \left(0.01 \cdot \left(CO_{2o} - CO_{2i}\right)\right) + W_s \cdot r_{CO2} \end{bmatrix} \end{array} \right.$$

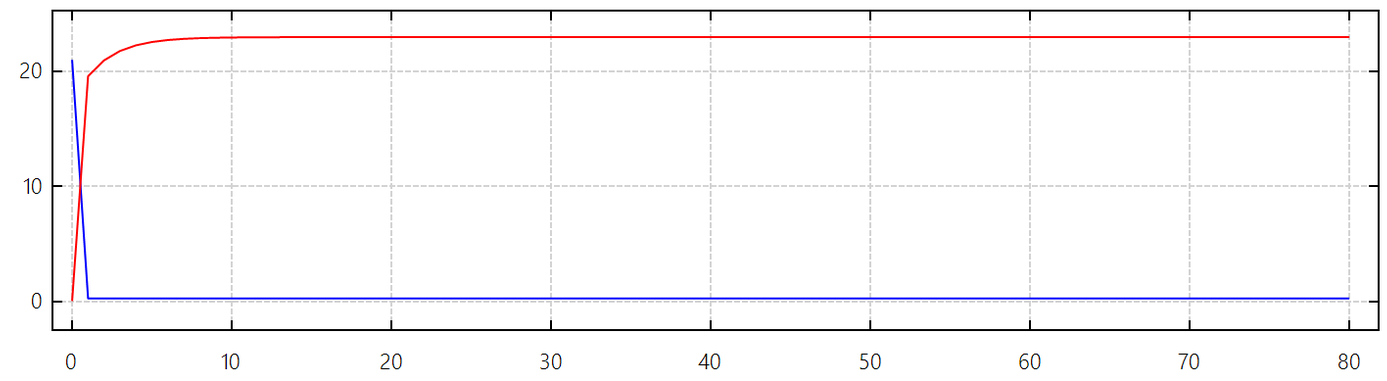
$oco_0 := \text{stack}(21.0, 0.03)$ $t_{min} := 0$ $t_{max} := 80$ $steps := 80$

$AbsTol := 10^{-9}$ $RelTol := 10^{-9}$

$oco := \text{dn\_GearsBDF}(oco_0, t_{min}, t_{max}, steps, D)$

$O_{2i} := \text{augment}(\text{col}(oco, 1), \text{col}(oco, 2))$

$CO_{2i} := \text{augment}(\text{col}(oco, 1), \text{col}(oco, 3))$




$\begin{cases} O_{2i} \\ CO_{2i} \end{cases}$