Bag Model

$\dot{z}_1 = z_2$

$\dot{z}_2 = \frac{A}{M}(P - P_b) - g$

$\dot{P}_b = \frac{\gamma RT}{Ad}(\dot{m}_{in} - \dot{m}_{escape})$ ($\dot{V}_b = 0$)

$\dot{P} = \frac{\gamma RT}{A z_1}\left(\dot{m}_{escape} - \dot{m}_{out} - \frac{PA z_2}{RT}\right)$

4 states, all observable, $\dot{m}_{in} = u$, single control

$\dot{m}_{in}$: input

$\dot{m}_{escape} = \frac{KA(P_b - P)}{\mu L}$ incompressible Darcy flow, fix this

$\dot{m}_{out} = \frac{PLz_1}{\sqrt{RT}}\sqrt{\frac{2\gamma}{\gamma-1}\left(\left(\frac{P_a}{P}\right)^{\frac{2}{\gamma}} - \left(\frac{P_a}{P}\right)^{\frac{\gamma+1}{\gamma}}\right)}$

At equilibrium

$z_1^* =$ Ride Height

$z_2^* = 0$

$\dot{m}_{in} = \dot{m}_{escape} = \dot{m}_{out} = Q$

3 equations $(\dot{z}_2, \dot{P}_b, \dot{P}) = 0$ in 3 unknowns (Q, P_b, P)

Next step, explicit (possibly?) solutions for Q^*, P_b^*, P^*