THC steady state stability

$$a\dot{\Delta S} = q|q| - b|q| + c \qquad (1)$$

where a is a box volume, b is $\frac{\alpha \Delta T}{K}$ and c is $\frac{F S_0 \beta}{K}$.

Consider perturbations about steady state solutions and take $\Delta S = \overline{\Delta S} + \Delta S'$, $q = \bar{q} + q'$

for $q > 0$

(1) becomes: $a(\dot{\overline{\Delta S}} + \dot{\Delta S}') = (\bar{q}+q')(\bar{q}+q') - b(\bar{q}+q') + c$

$$\Rightarrow \quad a(\dot{\Delta S}') = (\bar{q}^2 - b\bar{q} + c) - bq' + 2\bar{q}q' + (q')^2$$

$$\Rightarrow \quad a(\dot{\Delta S}') = (2\bar{q} - \frac{\alpha \Delta T}{K})q'$$

for $\bar{q} > \frac{\alpha \Delta T}{2K}$

$q' > 0 \Rightarrow \Delta S > 0$

which tends to decrease $q' \Rightarrow$ <u>Stable</u>

For $\bar{q} < \frac{\alpha \Delta T}{2K}$

$q' > 0 \Rightarrow \Delta S' < 0$

which tends to increase $q' \Rightarrow$ <u>Unstable</u>