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Dear Gene:

You may be interested to see how I have presented the subject of thermal stability in the summer course notes this year. The relevant pages are enclosed.

Best wishes,

Graham B. Wallis
Associate Professor
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GBW:eh
Encl.

stability is

$$\alpha q_e - m_b < 0 \quad (14.105)$$

In this case instability is reached before the peak flux and, on the return, before the minimum flux, as shown in Figure 14.20.

14.6.5 Pool Boiling From a Surface Which is Heated by Convection (Perhaps Condensation) From a Fluid at Constant Temperature T_1 .

Suppose that the convection heat transfer coefficient is h_1 (if the heat transfer is non-linear we must, of course, use the slope of the heat flux versus temperature curve instead). Then we have

$$q_1 = h_1 (T_1 - T) \quad (14.106)$$

Therefore

$$\left\{ \frac{\partial q_1}{\partial T} \right\}_{T_1} = -h_1 \quad (14.107)$$

The stability criterion now becomes

$$-h_1 - m_b < 0 \quad (14.108)$$

Thus a negative value of m_b can be counteracted by having a suitably large heat transfer coefficient h_1 . This was used experimentally by Berenson²⁹ and by Owens.²⁹

Of course a "constant temperature" fluid can only be approximated in practice since there will be some feedback between q and T_1 through the convection circuit. This does not affect the stability criterion (14.108) since one can still imagine perturbations in T which do not affect T_1 . However it does introduce new considerations, as follows. The overall heat transfer relationship between the heating fluid at T_1 and the boiling fluid at T_f is obtained by taking a certain heat flux and adding the temperature differences ($T_1 - T$) and $T - T_f$). This exercise is shown graphically in Figure 14.21 for various values of the convection coefficient h_1 . It is seen that for sufficiently low values of h_1 , the resulting curve now displays three values of