

114. cont.

$$\left[(q^F)^{\frac{s-r}{s}} - (q^i)^{\frac{s-r}{s}} \right] = \lambda (s-r) \left(\frac{H}{\lambda} \right)^{\frac{s-1}{s}} (t^r - t^i). \quad (1.4.20) \quad 2/4$$

Next use (1.4.21): $H = \lambda (q^i)^r (p^i)^s$ and rewrite

(1.4.20) in the form

$$(q^F)^{\frac{s-r}{s}} = (q^i)^{\frac{s-r}{s}} + \lambda (s-r) \underbrace{\left[(q^i)^r (p^i)^s \right]}_{\text{" } H/\lambda}^{\frac{s-1}{s}} (t^r - t^i) \Rightarrow$$

$$(q^F)^{\frac{s-r}{s}} = (q^i)^{\frac{s-r}{s}} + \lambda (s-r) (q^i)^{\frac{r(s-r)}{s}} (p^i)^{s-1} (t^r - t^i) \Rightarrow$$

$$(q^F)^{\frac{s-r}{s}} = (q^i)^{\frac{s-r}{s}} \left[1 + \lambda (s-r) (q^i)^{\frac{r(s-r)}{s} + \frac{r-s}{s}} (p^i)^{s-1} (t^r - t^i) \right] \Rightarrow$$

$$(q^F)^{\frac{s-r}{s}} = (q^i)^{\frac{s-r}{s}} \left[1 + \lambda (s-r) (q^i)^{(r-1)} (p^i)^{s-1} (t^r - t^i) \right] \Rightarrow$$

$$q^F = q^i \left[1 + \lambda (s-r) (t^r - t^i) (q^i)^{r-1} (p^i)^{s-1} \right]^{\frac{s}{s-r}} \quad (1.4.22)$$

Next work on (1.4.17). Solving (1.4.15) for q and putting

$$\text{this in (1.4.17)} \Rightarrow \dot{p} = -\lambda r \left(\frac{H}{\lambda} \right)^{\frac{r-1}{r}} p^{s/r} \Rightarrow$$

$$dp p^{-s/r} = -\lambda r \left(\frac{H}{\lambda} \right)^{\frac{r-1}{r}} dt \Rightarrow$$

$$\int_{p^i}^{p^F} dp p^{-s/r} = -\lambda r \left(\frac{H}{\lambda} \right)^{\frac{r-1}{r}} (t^r - t^i) \quad \star \star$$