

$$u_{yy} = \left( -\frac{\partial f}{\partial s} \frac{\partial}{\partial t} + \frac{1}{3} \frac{\partial g}{\partial t} \frac{\partial}{\partial y} \right) \left( -\frac{\partial f}{\partial s} \frac{\partial u}{\partial t} + \frac{1}{3} \frac{\partial g}{\partial t} \frac{\partial u}{\partial y} \right) \text{PAGE 2}$$

$$= \left( \frac{\partial f}{\partial s} \right)^2 u_{ff} + \frac{1}{9} \left( \frac{\partial g}{\partial t} \right)^2 u_{gg} - \frac{1}{3} \left( \frac{\partial f}{\partial s} \frac{\partial g}{\partial t} \right) u_{fg}$$

$$- \frac{1}{3} \left( \frac{\partial f}{\partial s} \frac{\partial g}{\partial t} \right) u_{gf}$$

$$u_{gf} = u_{fg}$$

So...

$$u_{yy} = \left( \frac{\partial f}{\partial s} \right)^2 u_{ff} + \frac{1}{9} \left( \frac{\partial g}{\partial t} \right)^2 u_{gg} - \frac{2}{3} \left( \frac{\partial f}{\partial s} \frac{\partial g}{\partial t} \right) u_{fg}$$

$$u_{xy} = \left( \frac{\partial f}{\partial s} \frac{\partial}{\partial t} + \frac{\partial g}{\partial t} \frac{\partial}{\partial y} \right) \left( -\frac{\partial f}{\partial s} \frac{\partial u}{\partial t} + \frac{1}{3} \frac{\partial g}{\partial t} \frac{\partial u}{\partial y} \right)$$

$$= - \left( \frac{\partial f}{\partial s} \right)^2 u_{ft} + \frac{1}{3} \left( \frac{\partial g}{\partial t} \right)^2 u_{gy} + \frac{1}{3} \left( \frac{\partial f}{\partial s} \frac{\partial g}{\partial t} \right) u_{fy}$$

$$- \left( \frac{\partial f}{\partial s} \frac{\partial g}{\partial t} \right) u_{gt}$$

$$u_{gt} = u_{tg}$$

$$u_{xy} = - \left( \frac{\partial f}{\partial s} \right)^2 u_{ft} + \frac{1}{3} \left( \frac{\partial g}{\partial t} \right)^2 u_{gy} - \frac{2}{3} \left( \frac{\partial f}{\partial s} \frac{\partial g}{\partial t} \right) u_{ty}$$