Schutz

~~4~~4.5. Eq. (4.14) a tensor?

$$T(\tilde{d}x^\alpha, \tilde{d}x^\beta) = T^{\alpha\beta} \equiv \left\{ \begin{array}{l} \text{flux of } \alpha \text{ momentum} \\ \text{across a surface of constant } x^\beta \end{array} \right\}.$$

p^α and x^β are both 4-vectors, so their components transforms contravariantly under a frame change. This transformation must be built into T to make it Lorentz invariant.

Specifically, $x^\beta \to \Lambda^{\bar{\mu}}{}_{\beta}\, x^\beta$

under change of frame.

$p^\alpha \to \Lambda^{\bar{\nu}}{}_{\alpha}\, p^\alpha$

Thus. ~~$T^{\alpha\beta} \to \Lambda^{\bar{\nu}\bar{\mu}}$~~ the transformation of T shall be

$$T^{\alpha\beta} \to T^{\bar{\nu}\bar{\mu}} = \Lambda^{\bar{\mu}}{}_{\beta}\, T^{\alpha\beta}\, \Lambda^{\bar{\nu}}{}_{\alpha}.$$

This transformation rules is tensorial.