> restart;with(Riemann):with(TensorPack): with(Canon):CDF(0): CDS(index):

Chapter XX Tensor analysis using indices - Senovilla et al. - Shearfree for acceleration parallel to vorticity if $\sigma_{ab}=0 \Rightarrow \omega\Theta=0$

Author: Peter Huf

eq75

> **read** "EFE" : **read** "SFE" :**read** "fids" :**read** "Seneqs80" :

>

> $eq[75] := (3 * \text{`}p'\text{`}^2/Psi^2 + 1/3) * theta^2 + 1/2 * mu + 3/2 * p = 0 : T(\%);$

$$\left(\frac{3\,p'^2}{\Psi^2} + \frac{1}{3} \right) \theta^2 + \frac{1}{2}\,\mu + \frac{3}{2}\,p = 0 \tag{1.1}$$

>

> $eq[72] : T(\%);$

$$\frac{\left(\left(\frac{3\,p'^2}{\Psi^2} + \frac{1}{3} \right) \theta^2 - 2\left(\Psi^2 + 1 \right) \omega^2 + \frac{1}{2}\,\mu + \frac{3}{2}\,p \right) p'}{\Psi^2} = \left(\frac{3\,p'^2}{\Psi^2} + \frac{1}{3} - \frac{PU p''}{p'} \right) \omega^2 \tag{1.2}$$

> $eq[73] : T(\%);$

$$2\left(\Psi^2 + 1 \right) p' + \left(\frac{3\,p'^2}{\Psi^2} + \frac{1}{3} - \frac{(\mu+p)\,p''}{p'} \right) \Psi^2 = 0 \tag{1.3}$$

>

> $temp1 := expand(TEDS(isolate(eq[73], \text{`}p''\text{`}), eq[72])) : T(\%);$

$$\frac{3\,p'^3\,\theta^2}{\Psi^4} + \frac{1}{3}\,\frac{p'\,\theta^2}{\Psi^2} - 2\,p'\,\omega^2 - \frac{2\,p'\,\omega^2}{\Psi^2} + \frac{1}{2}\,\frac{p'\,\mu}{\Psi^2} + \frac{3}{2}\,\frac{p'\,p}{\Psi^2} = -\frac{2\,\omega^2\,PU p'}{\mu+p} \tag{1.4}$$

$$-\frac{1}{3}\,\frac{\omega^2\,PU}{\mu+p} - \frac{3\,\omega^2\,PU p'^2}{\Psi^2\,(\mu+p)} + \frac{1}{3}\,\frac{\omega^2\,\mu}{\mu+p} + \frac{1}{3}\,\frac{\omega^2\,p}{\mu+p} + \frac{3\,\omega^2\,p'^2\,\mu}{\Psi^2\,(\mu+p)}$$

$$+\frac{3\,\omega^2\,p'^2\,p}{\Psi^2\,(\mu+p)} - \frac{2\,\omega^2\,PU p'}{\Psi^2\,(\mu+p)}$$

> $temp2 := (lhs(temp1) - rhs(temp1)) = 0 : T(\%);$

$$\frac{3\,p'^3\,\theta^2}{\Psi^4} + \frac{1}{3}\,\frac{p'\,\theta^2}{\Psi^2} - 2\,p'\,\omega^2 - \frac{2\,p'\,\omega^2}{\Psi^2} + \frac{1}{2}\,\frac{p'\,\mu}{\Psi^2} + \frac{3}{2}\,\frac{p'\,p}{\Psi^2} + \frac{2\,\omega^2\,PU p'}{\mu+p} \tag{1.5}$$

$$+ \frac{1}{3} \frac{\omega^2 PU}{\mu + p} + \frac{3 \omega^2 PU p^2}{\Psi^2 (\mu + p)} - \frac{1}{3} \frac{\omega^2 \mu}{\mu + p} - \frac{1}{3} \frac{\omega^2 p}{\mu + p} - \frac{3 \omega^2 p^2 \mu}{\Psi^2 (\mu + p)}$$

$$- \frac{3 \omega^2 p^2 p}{\Psi^2 (\mu + p)} + \frac{2 \omega^2 PU p'}{\Psi^2 (\mu + p)} = 0$$

> $temp3 := collect\left(expand\left(\frac{6 \cdot TEDS\left(PU = mu + p, \, expand\left(\Psi^4 \cdot temp2\right)\right)}{`p'` \cdot \Psi^2 \cdot 6} \right), [theta] \right) : T(\%);$

$$\left(\frac{3 p^2}{\Psi^2} + \frac{1}{3} \right) \theta^2 + \frac{1}{2} \mu + \frac{3}{2} p = 0 \tag{1.6}$$

>

> $convert(temp3, string);$

$$\text{"(3*`p'`^2/Psi^2+1/3)*theta^2+1/2*mu+3/2*p = 0"} \tag{1.7}$$

>

>

which is SSSeq75

proof completed

>

>

>

proof completed