```
> 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 $\sigma_{a\,b}$=0 =>ωΘ=0

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eq76 - time-propogation of SSSeq75

```
> read "EFE" : read "SFE" :read "fids" :read "Seneqs80" :
> eq[76] := theta * (3 * `p'` + 1) * (mu + p) = 0 : T(%);
```

$$\theta\,(3\,p'+1)\,(\mu+p)=0 \tag{1.1}$$

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

$$\left(\frac{3\,p^2}{\Psi^2}+\frac{1}{3}\right)\theta^2+\frac{1}{2}\,\mu+\frac{3}{2}\,p=0 \tag{1.2}$$

```
>
> temp1 := expand(Ψ^2·dotT(eq[75])) : T(%);
```

$$6\,\theta^2\,p'\,dotp'-\frac{6\,\theta^2\,p^2\,dotPsi}{\Psi}+6\,\theta\,dottheta\,p^2+\frac{2}{3}\,\Psi^2\,\theta\,dottheta+\frac{1}{2}\,\Psi^2\,dotmu+\frac{3}{2}\,\Psi^2\,dotp=0 \tag{1.3}$$

```
>
```

we use the identities:

$dotp=-p'\theta\,(\mu+p)$

$dotp'=-p''\theta\,(\mu+p)$

```
> temp2 := dotp =- `p'`·θ·(μ + p) : T(%);
```

$$dotp=-p'\,\theta\,(\mu+p) \tag{1.4}$$

```
> temp3 := `dotp'`=- `p''`·θ·(μ + p) : T(%);
```

$$dotp'=-p''\,\theta\,(\mu+p) \tag{1.5}$$

```
> temp4 := eq[65] : T(%);
```

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

```
> temp5 := TEDS(thetadot = dottheta, eq[69]) : T(%);
```

$$dottheta=\frac{3\,p^2\,\theta^2}{\Psi^2} \tag{1.7}$$

```
> temp6 := dotmu =-θ·(μ + p) : T(%);
```

$$dotmu=-\theta\,(\mu+p) \tag{1.8}$$

>

> $temp7 := \frac{1}{-3 \cdot \Psi^4}\left(factor\left(6 \cdot \Psi^2 \cdot TEDS(temp6, TEDS(temp5, TEDS(temp4, TEDS(temp3, TEDS(temp2, temp1)))))\right)\right) : T(\%);$

$$\theta\,(3\,p' + 1)\,(\mu + p) = 0 \qquad \textbf{(1.9)}$$

>

>

> $convert(temp7, string);$

$$\text{"theta*(3*`p'`+1)*(mu+p) = 0"} \qquad \textbf{(1.10)}$$

>

>

which is SSSeq76

proof completed

>

furthermore, form SSSeq76, if p=-1/3, the SSSeq73 and 75 become

> $temp8 := expand\left(subs\left(`p'` = \frac{1}{3},\ `p''` = 0,\ eq[73]\right)\right) : T(\%);$

$$\Psi^2 + 1 = 0 \qquad \textbf{(1.11)}$$

which is impossibe, hence theta=0 and the theorem for this sub-case is proven.

>

>

proof completed