```
> 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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eq72

```
> read "EFE" : read "SFE" :read "fids" :read "Seneqs80" :
> SSSeq72 := ((3 * `p'`^2/Psi^2 + 1/3) * theta^2-2 * (Psi^2 + 1) * omega^2 + 1/2 * mu + 3
      /2 * p) * `p'`/Psi^2 = (3·(`p'`/Psi)^2 + 1/3 - PU·`p''`/`p'`) * omega^2 : T(%);
```

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

proof of eq72: We commence with SSSeq70 and SSSeq71:

```
> temp := eq[70] : T(%);
```

$$\frac{p'\Psi_{;a}\omega^{a}}{\Psi^2}=\frac{1}{3}\,\frac{\left(-3PU\Psi^2p''+\Psi^2p'+9p^3\right)\omega^2}{\Psi^2p'} \tag{1.2}$$

```
> temp2 := eq[71] : T(%);
```

$$\Psi_{;a}\omega^{a}=\left(\frac{3p^2}{\Psi^2}+\frac{1}{3}\right)\theta^2-2\left(\Psi^2+1\right)\omega^2+\frac{1}{2}\mu+\frac{3}{2}p \tag{1.3}$$

so we see

```
> temp3 := rhs(temp2)·`p'`/Psi^2 = rhs(temp) : T(%);
```

$$\frac{\left(\left(\frac{3p^2}{\Psi^2}+\frac{1}{3}\right)\theta^2-2\left(\Psi^2+1\right)\omega^2+\frac{1}{2}\mu+\frac{3}{2}p\right)p'}{\Psi^2}=\frac{1}{3}\,\frac{\left(-3PU\Psi^2p''+\Psi^2p'+9p^3\right)\omega^2}{\Psi^2p'} \tag{1.4}$$

```
> convert(temp3, string);
```

```
"((3*`p'`^2/Psi^2+1/3)*theta^2-2*(Psi^2+1)*omega^2+1/2*mu+3/2*p)*`p'`/Psi^2 =
    1/3/Psi^2/`p'`*(-3*PU*Psi^2*`p''`+Psi^2*`p'`+9*`p'`^3)*omega^2"
```

(1.5)

```
>
>
```

which is SSSeq72

```
> SSSeq72 := ((3 * `p'`^2/Psi^2 + 1/3) * theta^2-2 * (Psi^2 + 1) * omega^2 + 1/2 * mu + 3
```

```
/2*p)*`p'`/Psi^2 = (3·(`p'`/Psi)^2 + 1/3 − PU·`p''`/`p'`)*omega^2 : T(%);
```

$$\frac{\left(\left(\frac{3p^2}{\Psi^2}+\frac{1}{3}\right)\theta^2-2\left(\Psi^2+1\right)\omega^2+\frac{1}{2}\mu+\frac{3}{2}p\right)p'}{\Psi^2}=\left(\frac{3p^2}{\Psi^2}+\frac{1}{3}-\frac{PUp''}{p'}\right)\omega^2 \quad \textbf{(1.6)}$$

check

```
> expand(lhs(temp3)-rhs(temp3) − lhs(SSSeq72) + rhs(SSSeq72));
```

$$0 \quad \textbf{(1.7)}$$

```
>
>
>
```