```
> 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 $\sigma_{a\,b}=0 \Rightarrow \omega\Theta=0$

Author: Peter Huf

eq68

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

proof of eq68: We commence with eq67

```
> temp := eq[67] : T(%);
```

$$P_{a\,b}\,\omega^{b\,\,d}{}_{;d} = -\frac{2\,p'\theta\,\omega^{a}}{\Psi} \tag{1.1}$$

```
> temp2 := temp·omega[-c, a] : T(%);
```

$$\omega_{c}{}^{a}\,P_{a\,b}\,\omega^{b\,\,d}{}_{;d} = -\frac{2\,\omega_{c}{}^{a}\,p'\theta\,\omega^{a}}{\Psi} \tag{1.2}$$

```
> temp3 := TEDS(omega[-c, a]·omega[a] = 0, temp2) : T(%);
```

$$\omega_{c}{}^{a}\,P_{a\,b}\,\omega^{b\,\,d}{}_{;d} = 0 \tag{1.3}$$

```
> temp4 := Absorbg(TEDS(P[-a,-b] = g[-a,-b] + u[-a]·u[-b], temp3)) : T(%);
```

0, "not a tensor"

$$\omega_{c}{}^{a}\,\omega^{b\,\,d}{}_{;d}\,u_{a}\,u_{b} + \omega_{c\,b}\,\omega^{b\,\,d}{}_{;d} = 0 \tag{1.4}$$

```
> temp5 := TEDS(omega[-c, a]·u[-a] = 0, temp4) : T(%);
```

$$\omega_{c\,b}\,\omega^{b\,\,d}{}_{;d} = 0 \tag{1.5}$$

Now using eq29

```
> temp6 := subs(c = d, C = D, a = c, eq[29]) : T(%);
```

$$\omega_{c\,b}\,\omega^{b\,\,d}{}_{;d} = -\omega^{2}\,du_{c} + P_{c}{}^{b}\,\omega^{d}\,\omega_{b\,;d} - P_{c}{}^{b}\,\omega^{d}\,\omega_{d\,;b} + du^{b}\,\omega_{b}\,\omega_{c} \tag{1.6}$$

```
> temp6a := rhs(temp6) = lhs(temp6) : T(%);
```

$$-\omega^{2}\,du_{c} + P_{c}{}^{b}\,\omega^{d}\,\omega_{b\,;d} - P_{c}{}^{b}\,\omega^{d}\,\omega_{d\,;b} + du^{b}\,\omega_{b}\,\omega_{c} = \omega_{c\,b}\,\omega^{b\,\,d}{}_{;d} \tag{1.7}$$

```
> temp7 := TEDS(temp5, temp6a) : T(%);
```

$$-\omega^{2}\,du_{c} + P_{c}{}^{b}\,\omega^{d}\,\omega_{b\,;d} - P_{c}{}^{b}\,\omega^{d}\,\omega_{d\,;b} + du^{b}\,\omega_{b}\,\omega_{c} = 0 \tag{1.8}$$

```
> temp8 := TEDS(du[b] = Psi·omega[b], temp7) : T(%);
```

$$\omega_{b}\,\omega_{c}\,\Psi\,\omega^{b} - \omega^{2}\,du_{c} + P_{c}{}^{b}\,\omega^{d}\,\omega_{b\,;d} - P_{c}{}^{b}\,\omega^{d}\,\omega_{d\,;b} = 0 \tag{1.9}$$

```
> temp9 := TEDS(omega[b]·omega[-b] = ω·omega, temp8) : T(%);
```

$$\omega_{c}\,\Psi\,\omega^{2} - \omega^{2}\,du_{c} + P_{c}{}^{b}\,\omega^{d}\,\omega_{b\,;d} - P_{c}{}^{b}\,\omega^{d}\,\omega_{d\,;b} = 0 \tag{1.10}$$

```
> temp10 := TEDS(du[-c] = Psi·omega[-c], temp9) : T(%);
```

$$P_{c}{}^{b}\,\omega^{d}\,\omega_{b;d} - P_{c}{}^{b}\,\omega^{d}\,\omega_{d;b} = 0 \qquad \textbf{(1.11)}$$

which is eq68