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

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eq63

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

proof of eq63:

We commence with eq52

```
> temp := du[a] = Psi·omega[a] : T(%);
```

$$du^{a} = \Psi\, \omega^{a} \tag{1.1}$$

```
> temp2 := dotT(temp) : T(%);
```

$$dotdu^{a} = \Psi\, dotomega^{a} + dotPsi\, \omega^{a} \tag{1.2}$$

```
> temp3 := expand(P[a,-b]·subs(a=b, temp2)) : T(%);
```

$$P^{a}{}_{b}\, dotdu^{b} = \Psi\, P^{a}{}_{b}\, dotomega^{b} + dotPsi\, P^{a}{}_{b}\, \omega^{b} \tag{1.3}$$

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

$$P^{a}{}_{b}\, dotdu^{b} = \Psi\, u^{a} u_{b}\, dotomega^{b} + dotPsi\, \omega^{b} u^{a} u_{b} + \Psi\, dotomega^{a} + dotPsi\, \omega^{a} \tag{1.4}$$

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

$$P^{a}{}_{b}\, dotdu^{b} = \left(u^{a} u_{b}\, dotomega^{b} + dotomega^{a}\right) \Psi + dotPsi\, \omega^{a} \tag{1.5}$$

```
> temp6 := TEDS(dotomega[a] + dotomega[b]·u[a]·u[-b] = P[a,-b]·dotomega[b],
      temp5) : T(%);
```

$$P^{a}{}_{b}\, dotdu^{b} = \Psi\, P^{a}{}_{b}\, dotomega^{b} + dotPsi\, \omega^{a} \tag{1.6}$$

```
> temp7 := TEDS(eq[59], temp6) : T(%);
```

$$P^{a}{}_{b}\, dotdu^{b} = \Psi\, \theta\, \omega^{a} p' - \frac{2}{3}\, \Psi\, \theta\, \omega^{a} + dotPsi\, \omega^{a} \tag{1.7}$$

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

$$P^{a}{}_{b}\, dotdu^{b} = \frac{1}{3}\, \frac{du^{a} \left(3\, \Psi\, p'\, \theta - 2\, \Psi\, \theta + 3\, dotPsi\right)}{\Psi} \tag{1.8}$$

which is eq63