```
> restart;
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HOLDER NORMS AND ADJOINT CURRENTS IN 4D

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Definitions:

On a variety of independent variables (x,y,z,t), consider a 4 component vector VV with arbitrary component functions U,V,W,C.

Define the Holder Norm, of signature (a,b,c,e) degree p and homogeneity index n, as the function:

$$HolderNorm := (a\,\mathrm{U}(x, y, z, t)^p + b\,\mathrm{V}(x, y, z, t)^p + c\,\mathrm{W}(x, y, z, t)^p + e\,\mathrm{C}(x, y, z, t)^p)^{\left(\frac{n}{p}\right)}$$

Define a vector VVN homogeneous of degree n, by dividing the vector VV by the Holder Norm.

Define the Adjoint matrix as the matrix of cofactors transposed of the Jacobian matrix computed from VVN

Define the Adjoint current as the vector equal to the product of the Adoint matrix times the vector VVN.

THEOREM: For any vector VV made homogeneous of degree zero by dividing each component by a Holder norm of any signature and any exponent p, but with homogeneity index n=1, then (part 1) the associated Jacobian matrix has zero determinant and (part 2) the adjoint current has zero divergence with respect to the 4 independent variables.

PROOF:

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> with(linalg):
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Construct a vector with 4 arbitrary functions on a 4D variety.

```
> UU:=U(x,y,z,t);VV:=V(x,y,z,t);WW:=W(x,y,z,t);CC:=C(x,y,z,t);
```

$$UU := \mathrm{U}(x, y, z, t)$$
$$VV := \mathrm{V}(x, y, z, t)$$
$$WW := \mathrm{W}(x, y, z, t)$$
$$CC := \mathrm{C}(x, y, z, t)$$

Construct the Holder norm with arbitrary signature (a,b,c,e) and with homogeneity index n and power p.

```
> HolderNorm:=(a*UU^p+b*VV^p+c*WW^p+e*CC^p)^(n/p);
```

$$HolderNorm := (a\,\mathrm{U}(x, y, z, t)^p + b\,\mathrm{V}(x, y, z, t)^p + c\,\mathrm{W}(x, y, z, t)^p + e\,\mathrm{C}(x, y, z, t)^p)^{\left(\frac{n}{p}\right)}$$

Normalize the original vector by dividing each component by the Holder norm.

```
> VVN:=[UU/HolderNorm,VV/HolderNorm,WW/HolderNorm,CC/HolderNorm];
```

$$VVN := \left[\frac{\mathrm{U}(x, y, z, t)}{(a\,\mathrm{U}(x, y, z, t)^p + b\,\mathrm{V}(x, y, z, t)^p + c\,\mathrm{W}(x, y, z, t)^p + e\,\mathrm{C}(x, y, z, t)^p)^{\left(\frac{n}{p}\right)}}, \frac{\mathrm{V}(x, y, z, t)}{(a\,\mathrm{U}(x, y, z, t)^p + b\,\mathrm{V}(x, y, z, t)^p + c\,\mathrm{W}(x, y, z, t)^p + e\,\mathrm{C}(x, y, z, t)^p)^{\left(\frac{n}{p}\right)}}, \frac{\mathrm{W}(x, y, z, t)}{(a\,\mathrm{U}(x, y, z, t)^p + b\,\mathrm{V}(x, y, z, t)^p + c\,\mathrm{W}(x, y, z, t)^p + e\,\mathrm{C}(x, y, z, t)^p)^{\left(\frac{n}{p}\right)}}, \frac{\mathrm{C}(x, y, z, t)}{(a\,\mathrm{U}(x, y, z, t)^p + b\,\mathrm{V}(x, y, z, t)^p + c\,\mathrm{W}(x, y, z, t)^p + e\,\mathrm{C}(x, y, z, t)^p)^{\left(\frac{n}{p}\right)}}\right]$$

Compute the JAcobian matrix of the homogeneous vector, and the determinant of the JAcobian matrix.

```
> JJ:=jacobian(VVN,[x,y,z,t]):DET:=factor(det(JJ));
```

$$
\begin{aligned}
DET := \Bigg(& (-1+n)\left(-\left(\frac{\partial}{\partial x}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{C}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{W}(x,y,z,t)\right)\right. \\
& +\left(\frac{\partial}{\partial x}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x,y,z,t)\right) \\
& +\left(\frac{\partial}{\partial x}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x,y,z,t)\right) \\
& -\left(\frac{\partial}{\partial x}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{C}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{U}(x,y,z,t)\right) \\
& +\left(\frac{\partial}{\partial x}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x,y,z,t)\right) \\
& -\left(\frac{\partial}{\partial x}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x,y,z,t)\right) \\
& -\left(\frac{\partial}{\partial x}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x,y,z,t)\right) \\
& -\left(\frac{\partial}{\partial x}\mathrm{C}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{W}(x,y,z,t)\right) \\
& +\left(\frac{\partial}{\partial x}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{C}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{U}(x,y,z,t)\right) \\
& -\left(\frac{\partial}{\partial x}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x,y,z,t)\right) \\
& +\left(\frac{\partial}{\partial x}\mathrm{C}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{W}(x,y,z,t)\right) \\
& +\left(\frac{\partial}{\partial x}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x,y,z,t)\right) \\
& +\left(\frac{\partial}{\partial x}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{C}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{W}(x,y,z,t)\right) \\
& -\left(\frac{\partial}{\partial x}\mathrm{C}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{V}(x,y,z,t)\right) \\
& -\left(\frac{\partial}{\partial x}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x,y,z,t)\right) \\
& +\left(\frac{\partial}{\partial x}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x,y,z,t)\right) \\
& +\left(\frac{\partial}{\partial x}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x,y,z,t)\right) \\
& +\left(\frac{\partial}{\partial x}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{C}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{V}(x,y,z,t)\right) \\
& -\left(\frac{\partial}{\partial x}\mathrm{C}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{W}(x,y,z,t)\right) \\
& -\left(\frac{\partial}{\partial x}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x,y,z,t)\right) \\
& +\left(\frac{\partial}{\partial x}\mathrm{C}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{W}(x,y,z,t)\right) \\
& +\left(\frac{\partial}{\partial x}\mathrm{C}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{V}(x,y,z,t)\right) \\
& -\left(\frac{\partial}{\partial x}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x,y,z,t)\right)
\end{aligned}
$$

$$
\begin{aligned}
&- \left(\frac{\partial}{\partial x} \mathrm{W}(x, y, z, t)\right)\left(\frac{\partial}{\partial y} \mathrm{C}(x, y, z, t)\right)\left(\frac{\partial}{\partial z} \mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial t} \mathrm{V}(x, y, z, t)\right)\Big)\Big)\Big) \Bigg/ \\
&\left(\left(a\, \mathrm{U}(x, y, z, t)^p + b\, \mathrm{V}(x, y, z, t)^p + c\, \mathrm{W}(x, y, z, t)^p + e\, \mathrm{C}(x, y, z, t)^p\right)^{\left(\frac{n}{p}\right)}\right)^4
\end{aligned}
$$

So determinant vanishes for n=1, any signature, and exponent p. QED part 1

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>
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Compute the Adjoint matrix and the current = [Adjoint matrix of JAcobian] | VVN>   any n, any p, any signature.

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> ADJ:=adj(JJ):
> Current:=subs(innerprod(ADJ,VVN));
```

$$
\begin{aligned}
\mathit{Current} := \Big[&- \Big(-\left(\frac{\partial}{\partial y} \mathrm{U}(x, y, z, t)\right) \mathrm{C}(x, y, z, t) \left(\frac{\partial}{\partial t} \mathrm{V}(x, y, z, t)\right)\left(\frac{\partial}{\partial z} \mathrm{W}(x, y, z, t)\right) \\
&+ \left(\frac{\partial}{\partial y} \mathrm{W}(x, y, z, t)\right) \mathrm{V}(x, y, z, t) \left(\frac{\partial}{\partial t} \mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial z} \mathrm{C}(x, y, z, t)\right) \\
&+ \left(\frac{\partial}{\partial y} \mathrm{C}(x, y, z, t)\right) \mathrm{V}(x, y, z, t) \left(\frac{\partial}{\partial z} \mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial t} \mathrm{W}(x, y, z, t)\right) \\
&+ \left(\frac{\partial}{\partial y} \mathrm{U}(x, y, z, t)\right) \mathrm{V}(x, y, z, t) \left(\frac{\partial}{\partial z} \mathrm{W}(x, y, z, t)\right)\left(\frac{\partial}{\partial t} \mathrm{C}(x, y, z, t)\right) \\
&- \left(\frac{\partial}{\partial y} \mathrm{V}(x, y, z, t)\right) \mathrm{U}(x, y, z, t) \left(\frac{\partial}{\partial z} \mathrm{W}(x, y, z, t)\right)\left(\frac{\partial}{\partial t} \mathrm{C}(x, y, z, t)\right) \\
&- \left(\frac{\partial}{\partial y} \mathrm{C}(x, y, z, t)\right) \mathrm{U}(x, y, z, t) \left(\frac{\partial}{\partial z} \mathrm{V}(x, y, z, t)\right)\left(\frac{\partial}{\partial t} \mathrm{W}(x, y, z, t)\right) \\
&- \left(\frac{\partial}{\partial y} \mathrm{W}(x, y, z, t)\right) \mathrm{U}(x, y, z, t) \left(\frac{\partial}{\partial t} \mathrm{V}(x, y, z, t)\right)\left(\frac{\partial}{\partial z} \mathrm{C}(x, y, z, t)\right) \\
&+ \left(\frac{\partial}{\partial y} \mathrm{W}(x, y, z, t)\right) \mathrm{C}(x, y, z, t) \left(\frac{\partial}{\partial z} \mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial t} \mathrm{V}(x, y, z, t)\right) \\
&+ \left(\frac{\partial}{\partial y} \mathrm{V}(x, y, z, t)\right) \mathrm{C}(x, y, z, t) \left(\frac{\partial}{\partial t} \mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial z} \mathrm{W}(x, y, z, t)\right) \\
&- \left(\frac{\partial}{\partial y} \mathrm{W}(x, y, z, t)\right) \mathrm{C}(x, y, z, t) \left(\frac{\partial}{\partial t} \mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial z} \mathrm{V}(x, y, z, t)\right) \\
&- \left(\frac{\partial}{\partial y} \mathrm{V}(x, y, z, t)\right) \mathrm{C}(x, y, z, t) \left(\frac{\partial}{\partial z} \mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial t} \mathrm{W}(x, y, z, t)\right) \\
&+ \left(\frac{\partial}{\partial y} \mathrm{U}(x, y, z, t)\right) \mathrm{C}(x, y, z, t) \left(\frac{\partial}{\partial z} \mathrm{V}(x, y, z, t)\right)\left(\frac{\partial}{\partial t} \mathrm{W}(x, y, z, t)\right) \\
&+ \left(\frac{\partial}{\partial y} \mathrm{V}(x, y, z, t)\right) \mathrm{W}(x, y, z, t) \left(\frac{\partial}{\partial z} \mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial t} \mathrm{C}(x, y, z, t)\right) \\
&+ \left(\frac{\partial}{\partial y} \mathrm{C}(x, y, z, t)\right) \mathrm{W}(x, y, z, t) \left(\frac{\partial}{\partial t} \mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial z} \mathrm{V}(x, y, z, t)\right) \\
&+ \left(\frac{\partial}{\partial y} \mathrm{U}(x, y, z, t)\right) \mathrm{W}(x, y, z, t) \left(\frac{\partial}{\partial t} \mathrm{V}(x, y, z, t)\right)\left(\frac{\partial}{\partial z} \mathrm{C}(x, y, z, t)\right) \\
&+ \left(\frac{\partial}{\partial y} \mathrm{C}(x, y, z, t)\right) \mathrm{U}(x, y, z, t) \left(\frac{\partial}{\partial t} \mathrm{V}(x, y, z, t)\right)\left(\frac{\partial}{\partial z} \mathrm{W}(x, y, z, t)\right) \\
&+ \left(\frac{\partial}{\partial y} \mathrm{V}(x, y, z, t)\right) \mathrm{U}(x, y, z, t) \left(\frac{\partial}{\partial t} \mathrm{W}(x, y, z, t)\right)\left(\frac{\partial}{\partial z} \mathrm{C}(x, y, z, t)\right) \\
&+ \left(\frac{\partial}{\partial y} \mathrm{W}(x, y, z, t)\right) \mathrm{U}(x, y, z, t) \left(\frac{\partial}{\partial z} \mathrm{V}(x, y, z, t)\right)\left(\frac{\partial}{\partial t} \mathrm{C}(x, y, z, t)\right)
\end{aligned}
$$

$$-\left(\frac{\partial}{\partial y}\mathrm{W}(x, y, z, t)\right)\mathrm{V}(x, y, z, t)\left(\frac{\partial}{\partial z}\mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x, y, z, t)\right)$$

$$-\left(\frac{\partial}{\partial y}\mathrm{C}(x, y, z, t)\right)\mathrm{V}(x, y, z, t)\left(\frac{\partial}{\partial t}\mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial z}\mathrm{W}(x, y, z, t)\right)$$

$$-\left(\frac{\partial}{\partial y}\mathrm{U}(x, y, z, t)\right)\mathrm{V}(x, y, z, t)\left(\frac{\partial}{\partial t}\mathrm{W}(x, y, z, t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x, y, z, t)\right)$$

$$-\left(\frac{\partial}{\partial y}\mathrm{C}(x, y, z, t)\right)\mathrm{W}(x, y, z, t)\left(\frac{\partial}{\partial z}\mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial t}\mathrm{V}(x, y, z, t)\right)$$

$$-\left(\frac{\partial}{\partial y}\mathrm{U}(x, y, z, t)\right)\mathrm{W}(x, y, z, t)\left(\frac{\partial}{\partial z}\mathrm{V}(x, y, z, t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x, y, z, t)\right)$$

$$-\left(\frac{\partial}{\partial y}\mathrm{V}(x, y, z, t)\right)\mathrm{W}(x, y, z, t)\left(\frac{\partial}{\partial t}\mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x, y, z, t)\right)\Big)\Big) \Big/$$

$$\left(\left(a\,\mathrm{U}(x, y, z, t)^{p} + b\,\mathrm{V}(x, y, z, t)^{p} + c\,\mathrm{W}(x, y, z, t)^{p} + e\,\mathrm{C}(x, y, z, t)^{p}\right)^{\left(\frac{n}{p}\right)}\right)^{4}, \Big($$

$$\left(\frac{\partial}{\partial x}\mathrm{V}(x, y, z, t)\right)\mathrm{W}(x, y, z, t)\left(\frac{\partial}{\partial z}\mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x, y, z, t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{U}(x, y, z, t)\right)\mathrm{W}(x, y, z, t)\left(\frac{\partial}{\partial t}\mathrm{V}(x, y, z, t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x, y, z, t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{C}(x, y, z, t)\right)\mathrm{W}(x, y, z, t)\left(\frac{\partial}{\partial t}\mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial z}\mathrm{V}(x, y, z, t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{C}(x, y, z, t)\right)\mathrm{V}(x, y, z, t)\left(\frac{\partial}{\partial z}\mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial t}\mathrm{W}(x, y, z, t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{U}(x, y, z, t)\right)\mathrm{V}(x, y, z, t)\left(\frac{\partial}{\partial z}\mathrm{W}(x, y, z, t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x, y, z, t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{W}(x, y, z, t)\right)\mathrm{V}(x, y, z, t)\left(\frac{\partial}{\partial t}\mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x, y, z, t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{W}(x, y, z, t)\right)\mathrm{U}(x, y, z, t)\left(\frac{\partial}{\partial z}\mathrm{V}(x, y, z, t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x, y, z, t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{V}(x, y, z, t)\right)\mathrm{U}(x, y, z, t)\left(\frac{\partial}{\partial t}\mathrm{W}(x, y, z, t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x, y, z, t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{C}(x, y, z, t)\right)\mathrm{U}(x, y, z, t)\left(\frac{\partial}{\partial t}\mathrm{V}(x, y, z, t)\right)\left(\frac{\partial}{\partial z}\mathrm{W}(x, y, z, t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{W}(x, y, z, t)\right)\mathrm{C}(x, y, z, t)\left(\frac{\partial}{\partial z}\mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial t}\mathrm{V}(x, y, z, t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{U}(x, y, z, t)\right)\mathrm{C}(x, y, z, t)\left(\frac{\partial}{\partial z}\mathrm{V}(x, y, z, t)\right)\left(\frac{\partial}{\partial t}\mathrm{W}(x, y, z, t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{V}(x, y, z, t)\right)\mathrm{C}(x, y, z, t)\left(\frac{\partial}{\partial t}\mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial z}\mathrm{W}(x, y, z, t)\right)$$

$$-\left(\frac{\partial}{\partial x}\mathrm{V}(x, y, z, t)\right)\mathrm{W}(x, y, z, t)\left(\frac{\partial}{\partial t}\mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x, y, z, t)\right)$$

$$-\left(\frac{\partial}{\partial x}\mathrm{U}(x, y, z, t)\right)\mathrm{W}(x, y, z, t)\left(\frac{\partial}{\partial z}\mathrm{V}(x, y, z, t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x, y, z, t)\right)$$

$$-\left(\frac{\partial}{\partial x}\mathrm{C}(x, y, z, t)\right)\mathrm{W}(x, y, z, t)\left(\frac{\partial}{\partial z}\mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial t}\mathrm{V}(x, y, z, t)\right)$$

$$-\left(\frac{\partial}{\partial x}\mathrm{C}(x, y, z, t)\right)\mathrm{V}(x, y, z, t)\left(\frac{\partial}{\partial t}\mathrm{U}(x, y, z, t)\right)\left(\frac{\partial}{\partial z}\mathrm{W}(x, y, z, t)\right)$$

$$-\left(\frac{\partial}{\partial x}\mathrm{U}(x,y,z,t)\right)\mathrm{V}(x,y,z,t)\left(\frac{\partial}{\partial t}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}\mathrm{W}(x,y,z,t)\right)\mathrm{V}(x,y,z,t)\left(\frac{\partial}{\partial z}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}\mathrm{V}(x,y,z,t)\right)\mathrm{U}(x,y,z,t)\left(\frac{\partial}{\partial z}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}\mathrm{C}(x,y,z,t)\right)\mathrm{U}(x,y,z,t)\left(\frac{\partial}{\partial z}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{W}(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}\mathrm{W}(x,y,z,t)\right)\mathrm{U}(x,y,z,t)\left(\frac{\partial}{\partial t}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}\mathrm{U}(x,y,z,t)\right)\mathrm{C}(x,y,z,t)\left(\frac{\partial}{\partial t}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{W}(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}\mathrm{V}(x,y,z,t)\right)\mathrm{C}(x,y,z,t)\left(\frac{\partial}{\partial z}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{W}(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}\mathrm{W}(x,y,z,t)\right)\mathrm{C}(x,y,z,t)\left(\frac{\partial}{\partial t}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{V}(x,y,z,t)\right)\Bigg)\Bigg) \Bigg/$$
$$\left(\left(a\,\mathrm{U}(x,y,z,t)^{p}+b\,\mathrm{V}(x,y,z,t)^{p}+c\,\mathrm{W}(x,y,z,t)^{p}+e\,\mathrm{C}(x,y,z,t)^{p}\right)^{\left(\frac{n}{p}\right)}\right)^{4}, \Bigg(\Bigg($$
$$\left(\frac{\partial}{\partial x}\mathrm{U}(x,y,z,t)\right)\mathrm{W}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}\mathrm{V}(x,y,z,t)\right)\mathrm{W}(x,y,z,t)\left(\frac{\partial}{\partial t}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{C}(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}\mathrm{C}(x,y,z,t)\right)\mathrm{W}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{V}(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}\mathrm{U}(x,y,z,t)\right)\mathrm{V}(x,y,z,t)\left(\frac{\partial}{\partial t}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{C}(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}\mathrm{C}(x,y,z,t)\right)\mathrm{V}(x,y,z,t)\left(\frac{\partial}{\partial t}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{W}(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}\mathrm{W}(x,y,z,t)\right)\mathrm{V}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}\mathrm{V}(x,y,z,t)\right)\mathrm{U}(x,y,z,t)\left(\frac{\partial}{\partial t}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{C}(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}\mathrm{W}(x,y,z,t)\right)\mathrm{U}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}\mathrm{C}(x,y,z,t)\right)\mathrm{U}(x,y,z,t)\left(\frac{\partial}{\partial t}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{W}(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}\mathrm{V}(x,y,z,t)\right)\mathrm{C}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{W}(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}\mathrm{U}(x,y,z,t)\right)\mathrm{C}(x,y,z,t)\left(\frac{\partial}{\partial t}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{W}(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}\mathrm{W}(x,y,z,t)\right)\mathrm{C}(x,y,z,t)\left(\frac{\partial}{\partial t}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{V}(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}\mathrm{V}(x,y,z,t)\right)\mathrm{W}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}\mathrm{C}(x,y,z,t)\right)\mathrm{W}(x,y,z,t)\left(\frac{\partial}{\partial t}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{V}(x,y,z,t)\right)$$

$$-\left(\frac{\partial}{\partial x}\mathrm{U}(x,y,z,t)\right)\mathrm{W}(x,y,z,t)\left(\frac{\partial}{\partial t}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{C}(x,y,z,t)\right)$$

$$-\left(\frac{\partial}{\partial x}\mathrm{W}(x,y,z,t)\right)\mathrm{V}(x,y,z,t)\left(\frac{\partial}{\partial t}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{C}(x,y,z,t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{V}(x,y,z,t)\right)\mathrm{U}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x,y,z,t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{W}(x,y,z,t)\right)\mathrm{U}(x,y,z,t)\left(\frac{\partial}{\partial t}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{C}(x,y,z,t)\right)$$

$$-\left(\frac{\partial}{\partial x}\mathrm{U}(x,y,z,t)\right)\mathrm{V}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{C}(x,y,z,t)\right)$$

$$-\left(\frac{\partial}{\partial x}\mathrm{C}(x,y,z,t)\right)\mathrm{V}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{W}(x,y,z,t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{C}(x,y,z,t)\right)\mathrm{U}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{W}(x,y,z,t)\right)$$

$$-\left(\frac{\partial}{\partial x}\mathrm{V}(x,y,z,t)\right)\mathrm{C}(x,y,z,t)\left(\frac{\partial}{\partial t}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{W}(x,y,z,t)\right)$$

$$-\left(\frac{\partial}{\partial x}\mathrm{U}(x,y,z,t)\right)\mathrm{C}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{W}(x,y,z,t)\right)$$

$$-\left(\frac{\partial}{\partial x}\mathrm{W}(x,y,z,t)\right)\mathrm{C}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial t}\mathrm{V}(x,y,z,t)\right)\Bigg)\Bigg/$$

$$\left(\left(a\,\mathrm{U}(x,y,z,t)^p+b\,\mathrm{V}(x,y,z,t)^p+c\,\mathrm{W}(x,y,z,t)^p+e\,\mathrm{C}(x,y,z,t)^p\right)^{\left(\frac{n}{p}\right)}\right)^4,\Bigg($$

$$-\left(\frac{\partial}{\partial x}\mathrm{V}(x,y,z,t)\right)\mathrm{W}(x,y,z,t)\left(\frac{\partial}{\partial z}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{C}(x,y,z,t)\right)$$

$$-\left(\frac{\partial}{\partial x}\mathrm{U}(x,y,z,t)\right)\mathrm{W}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x,y,z,t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{W}(x,y,z,t)\right)\mathrm{V}(x,y,z,t)\left(\frac{\partial}{\partial z}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{C}(x,y,z,t)\right)$$

$$-\left(\frac{\partial}{\partial x}\mathrm{C}(x,y,z,t)\right)\mathrm{W}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{V}(x,y,z,t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{U}(x,y,z,t)\right)\mathrm{V}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x,y,z,t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{C}(x,y,z,t)\right)\mathrm{V}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{W}(x,y,z,t)\right)$$

$$-\left(\frac{\partial}{\partial x}\mathrm{W}(x,y,z,t)\right)\mathrm{U}(x,y,z,t)\left(\frac{\partial}{\partial z}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{C}(x,y,z,t)\right)$$

$$-\left(\frac{\partial}{\partial x}\mathrm{C}(x,y,z,t)\right)\mathrm{U}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{W}(x,y,z,t)\right)$$

$$-\left(\frac{\partial}{\partial x}\mathrm{V}(x,y,z,t)\right)\mathrm{U}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{W}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x,y,z,t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{C}(x,y,z,t)\right)\mathrm{W}(x,y,z,t)\left(\frac{\partial}{\partial z}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{V}(x,y,z,t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{U}(x,y,z,t)\right)\mathrm{W}(x,y,z,t)\left(\frac{\partial}{\partial z}\mathrm{V}(x,y,z,t)\right)\left(\frac{\partial}{\partial y}\mathrm{C}(x,y,z,t)\right)$$

$$+\left(\frac{\partial}{\partial x}\mathrm{V}(x,y,z,t)\right)\mathrm{W}(x,y,z,t)\left(\frac{\partial}{\partial y}\mathrm{U}(x,y,z,t)\right)\left(\frac{\partial}{\partial z}\mathrm{C}(x,y,z,t)\right)$$

$$-\left(\frac{\partial}{\partial x}W(x,y,z,t)\right)V(x,y,z,t)\left(\frac{\partial}{\partial y}U(x,y,z,t)\right)\left(\frac{\partial}{\partial z}C(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}C(x,y,z,t)\right)V(x,y,z,t)\left(\frac{\partial}{\partial z}U(x,y,z,t)\right)\left(\frac{\partial}{\partial y}W(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}U(x,y,z,t)\right)V(x,y,z,t)\left(\frac{\partial}{\partial z}W(x,y,z,t)\right)\left(\frac{\partial}{\partial y}C(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}W(x,y,z,t)\right)U(x,y,z,t)\left(\frac{\partial}{\partial y}V(x,y,z,t)\right)\left(\frac{\partial}{\partial z}C(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}V(x,y,z,t)\right)U(x,y,z,t)\left(\frac{\partial}{\partial z}W(x,y,z,t)\right)\left(\frac{\partial}{\partial y}C(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}C(x,y,z,t)\right)U(x,y,z,t)\left(\frac{\partial}{\partial z}V(x,y,z,t)\right)\left(\frac{\partial}{\partial y}W(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}V(x,y,z,t)\right)C(x,y,z,t)\left(\frac{\partial}{\partial z}U(x,y,z,t)\right)\left(\frac{\partial}{\partial y}W(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}V(x,y,z,t)\right)C(x,y,z,t)\left(\frac{\partial}{\partial y}U(x,y,z,t)\right)\left(\frac{\partial}{\partial z}W(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}U(x,y,z,t)\right)C(x,y,z,t)\left(\frac{\partial}{\partial y}V(x,y,z,t)\right)\left(\frac{\partial}{\partial z}W(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}U(x,y,z,t)\right)C(x,y,z,t)\left(\frac{\partial}{\partial z}V(x,y,z,t)\right)\left(\frac{\partial}{\partial y}W(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}W(x,y,z,t)\right)C(x,y,z,t)\left(\frac{\partial}{\partial z}U(x,y,z,t)\right)\left(\frac{\partial}{\partial y}V(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}W(x,y,z,t)\right)C(x,y,z,t)\left(\frac{\partial}{\partial y}U(x,y,z,t)\right)\left(\frac{\partial}{\partial z}V(x,y,z,t)\right)\Bigg) \Bigg/$$
$$\left(\left(a\,U(x,y,z,t)^p+b\,V(x,y,z,t)^p+c\,W(x,y,z,t)^p+e\,C(x,y,z,t)^p\right)^{\left(\frac{n}{p}\right)}\right)^4\Bigg]$$

>

Compute the divergence of this Current

```
> DIVCurrent:=factor(diverge(Current,[x,y,z,t]));
```

$$DIVCurrent := -4\Bigg((-1+n)\Bigg(-\left(\frac{\partial}{\partial x}C(x,y,z,t)\right)\left(\frac{\partial}{\partial y}U(x,y,z,t)\right)\left(\frac{\partial}{\partial z}V(x,y,z,t)\right)\left(\frac{\partial}{\partial t}W(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}C(x,y,z,t)\right)\left(\frac{\partial}{\partial y}W(x,y,z,t)\right)\left(\frac{\partial}{\partial z}U(x,y,z,t)\right)\left(\frac{\partial}{\partial t}V(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}V(x,y,z,t)\right)\left(\frac{\partial}{\partial y}C(x,y,z,t)\right)\left(\frac{\partial}{\partial t}W(x,y,z,t)\right)\left(\frac{\partial}{\partial z}U(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}C(x,y,z,t)\right)\left(\frac{\partial}{\partial y}V(x,y,z,t)\right)\left(\frac{\partial}{\partial t}U(x,y,z,t)\right)\left(\frac{\partial}{\partial z}W(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}U(x,y,z,t)\right)\left(\frac{\partial}{\partial y}C(x,y,z,t)\right)\left(\frac{\partial}{\partial t}V(x,y,z,t)\right)\left(\frac{\partial}{\partial z}W(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}V(x,y,z,t)\right)\left(\frac{\partial}{\partial y}U(x,y,z,t)\right)\left(\frac{\partial}{\partial z}W(x,y,z,t)\right)\left(\frac{\partial}{\partial t}C(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}U(x,y,z,t)\right)\left(\frac{\partial}{\partial y}V(x,y,z,t)\right)\left(\frac{\partial}{\partial t}W(x,y,z,t)\right)\left(\frac{\partial}{\partial z}C(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}U(x,y,z,t)\right)\left(\frac{\partial}{\partial y}V(x,y,z,t)\right)\left(\frac{\partial}{\partial z}W(x,y,z,t)\right)\left(\frac{\partial}{\partial t}C(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}U(x,y,z,t)\right)\left(\frac{\partial}{\partial y}W(x,y,z,t)\right)\left(\frac{\partial}{\partial z}V(x,y,z,t)\right)\left(\frac{\partial}{\partial t}C(x,y,z,t)\right)$$

$$-\left(\frac{\partial}{\partial x}V(x,y,z,t)\right)\left(\frac{\partial}{\partial y}W(x,y,z,t)\right)\left(\frac{\partial}{\partial t}U(x,y,z,t)\right)\left(\frac{\partial}{\partial z}C(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}W(x,y,z,t)\right)\left(\frac{\partial}{\partial y}U(x,y,z,t)\right)\left(\frac{\partial}{\partial t}V(x,y,z,t)\right)\left(\frac{\partial}{\partial z}C(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}W(x,y,z,t)\right)\left(\frac{\partial}{\partial y}C(x,y,z,t)\right)\left(\frac{\partial}{\partial t}U(x,y,z,t)\right)\left(\frac{\partial}{\partial z}V(x,y,z,t)\right)$$
$$-\left(\frac{\partial}{\partial x}W(x,y,z,t)\right)\left(\frac{\partial}{\partial y}V(x,y,z,t)\right)\left(\frac{\partial}{\partial z}U(x,y,z,t)\right)\left(\frac{\partial}{\partial t}C(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}V(x,y,z,t)\right)\left(\frac{\partial}{\partial y}W(x,y,z,t)\right)\left(\frac{\partial}{\partial z}U(x,y,z,t)\right)\left(\frac{\partial}{\partial t}C(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}W(x,y,z,t)\right)\left(\frac{\partial}{\partial y}V(x,y,z,t)\right)\left(\frac{\partial}{\partial t}U(x,y,z,t)\right)\left(\frac{\partial}{\partial z}C(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}C(x,y,z,t)\right)\left(\frac{\partial}{\partial y}W(x,y,z,t)\right)\left(\frac{\partial}{\partial t}U(x,y,z,t)\right)\left(\frac{\partial}{\partial z}V(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}W(x,y,z,t)\right)\left(\frac{\partial}{\partial y}C(x,y,z,t)\right)\left(\frac{\partial}{\partial z}U(x,y,z,t)\right)\left(\frac{\partial}{\partial t}V(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}V(x,y,z,t)\right)\left(\frac{\partial}{\partial y}C(x,y,z,t)\right)\left(\frac{\partial}{\partial z}W(x,y,z,t)\right)\left(\frac{\partial}{\partial t}U(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}V(x,y,z,t)\right)\left(\frac{\partial}{\partial y}U(x,y,z,t)\right)\left(\frac{\partial}{\partial t}W(x,y,z,t)\right)\left(\frac{\partial}{\partial z}C(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}W(x,y,z,t)\right)\left(\frac{\partial}{\partial y}U(x,y,z,t)\right)\left(\frac{\partial}{\partial z}V(x,y,z,t)\right)\left(\frac{\partial}{\partial t}C(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}C(x,y,z,t)\right)\left(\frac{\partial}{\partial y}V(x,y,z,t)\right)\left(\frac{\partial}{\partial z}U(x,y,z,t)\right)\left(\frac{\partial}{\partial t}W(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}U(x,y,z,t)\right)\left(\frac{\partial}{\partial y}W(x,y,z,t)\right)\left(\frac{\partial}{\partial t}V(x,y,z,t)\right)\left(\frac{\partial}{\partial z}C(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}U(x,y,z,t)\right)\left(\frac{\partial}{\partial y}C(x,y,z,t)\right)\left(\frac{\partial}{\partial z}V(x,y,z,t)\right)\left(\frac{\partial}{\partial t}W(x,y,z,t)\right)$$
$$+\left(\frac{\partial}{\partial x}C(x,y,z,t)\right)\left(\frac{\partial}{\partial y}U(x,y,z,t)\right)\left(\frac{\partial}{\partial t}V(x,y,z,t)\right)\left(\frac{\partial}{\partial z}W(x,y,z,t)\right)\Bigg)\Bigg)\Bigg/$$
$$\left(\left(a\,U(x,y,z,t)^p + b\,V(x,y,z,t)^p + c\,W(x,y,z,t)^p + e\,C(x,y,z,t)^p\right)^{\left(\frac{n}{p}\right)}\right)^4$$

NOW SUBSTITUTE n = 1

```
> 
> DIVCurrent:=factor(subs(n=1,diverge(Current,[x,y,z,t])));
```

$$DIVCurrent := 0$$

QED part 2

```
> 
```