Let $\overline{u_\xi} = T(e^{+(\xi,x)})$. $\Rightarrow$ $T(\_) = (\sum u_\xi e^{i(\xi,x)})(\_)$

$\Rightarrow T(\varphi) = T(\sum \varphi_\xi e^{i(\xi,x)}) = \sum \varphi_\xi T(e^{i(\xi,x)}) = \sum \varphi_\xi \overline{u_\xi}$.

$\overline{T(f+ig)} = \overline{T(f)} + i\,\overline{T(g)} \Rightarrow T(f-ig) = T(f) - i\ T(g)$
$\Rightarrow \overline{T(f-ig)} = \overline{T(f)} + i\,\overline{T(g)} = T(f) + i\,T(g)$ (we can not conclude since $T(f)$ & $T(g)$ might not be real).
We will see if the arguments are consistent or not. :)

The δ-function is given by

$$\delta = \sum_\xi e^{i(\xi,x)}.$$

As usual, the torus will provide an excellent illustration of our general remarks.

Now let $A_c^q(\mathbb{R}^n)$ be the space of C^∞ q-forms on $\mathbb{R}^n$ with compact support. In the obvious way the topology on $C_c^\infty(\mathbb{R}^n)$ may be used componentwise to make $A_c^q(\mathbb{R}^n)$ into a complete topological vector space.

Definition. The topological dual of $A_c^{n-q}(\mathbb{R}^n)$ is the space of currents of degree q, and is denoted by $\mathcal{D}^q(\mathbb{R}^n)$.

Examples

1. In the following examples we will denote by $L^q(\mathbb{R}^n, loc)$ the q-forms $\psi = \sum \psi_I(x)\, dx_I$ whose coefficients are locally L^1 functions on $\mathbb{R}^n$. For such a ψ there is an associated current $T_\psi \in \mathcal{D}^q(\mathbb{R}^n)$ defined by

$$T_\psi(\varphi) = \int_{\mathbb{R}^n} \psi \wedge \varphi, \qquad \varphi \in A_c^{n-q}(\mathbb{R}^n).$$

2. If Γ is a piecewise smooth, oriented $(n-q)$ chain in $\mathbb{R}^n$,