For "everyday" harmonic/single-frequency sound fields, if the 3-D vector complex ***frequency-domain*** particle velocity amplitude $\vec{\tilde{u}}(\vec{r},\omega)$ is known/measured, then since the 3-D vector complex ***time-domain*** particle velocity $\vec{\tilde{u}}(\vec{r},t)=\vec{\tilde{u}}(\vec{r},\omega)\cdot e^{i\omega t}$, and the 3-D vector complex ***time-domain*** particle displacement $\vec{\tilde{\xi}}(\vec{r},t)=\vec{\tilde{\xi}}(\vec{r},\omega)\cdot e^{i\omega t}$, where: $\vec{\tilde{\xi}}(\vec{r},\omega)$ is the 3-D vector complex ***frequency-domain*** particle displacement amplitude, and since $\vec{\tilde{u}}(\vec{r},t)=\partial\vec{\tilde{\xi}}(\vec{r},t)/\partial t$, then:

$$\vec{\tilde{\xi}}(\vec{r},t)=\int\vec{\tilde{u}}(\vec{r},t)\,dt=\int\vec{\tilde{u}}(\vec{r},\omega)\cdot e^{i\omega t}dt=\vec{\tilde{u}}(\vec{r},\omega)\int\cdot e^{i\omega t}dt=\frac{1}{i\omega}\vec{\tilde{u}}(\vec{r},\omega)\cdot e^{i\omega t}$$

But since: $\vec{\tilde{\xi}}(\vec{r},t)=\vec{\tilde{\xi}}(\vec{r},\omega)\cdot e^{i\omega t}$, we see that: $\boxed{\vec{\tilde{\xi}}(\vec{r},\omega)=\frac{1}{i\omega}\vec{\tilde{u}}(\vec{r},\omega)=-i\frac{1}{\omega}\vec{\tilde{u}}(\vec{r},\omega)}$

Likewise, since: $\vec{\tilde{a}}(\vec{r},t)=\dfrac{\partial\vec{\tilde{u}}(\vec{r},t)}{\partial t}=\dfrac{\partial\vec{\tilde{u}}(\vec{r},\omega)\cdot e^{i\omega t}}{\partial t}=\vec{\tilde{u}}(\vec{r},\omega)\cdot\dfrac{\partial e^{i\omega t}}{\partial t}=i\omega\cdot\vec{\tilde{u}}(\vec{r},\omega)\cdot e^{i\omega t}$

But since: $\vec{\tilde{a}}(\vec{r},t)=\vec{\tilde{a}}(\vec{r},\omega)\cdot e^{i\omega t}$, we also see that: $\boxed{\vec{\tilde{a}}(\vec{r},\omega)=i\omega\cdot\vec{\tilde{u}}(\vec{r},\omega)}$