

Norms in other vector spaces

1. When an electrical system is shocked by, for example, a temporary blackout or brownout or a distant lightning strike, the system voltages will take time to return to their steady state (for now, the zero vector). We can measure how quickly a system returns to the steady state by measuring the 2-norm of the quantity. Suppose that the infinite sequence (discrete signal) is $x = (3.0, 1.5, 0.75, 0.375, 0.1875, 0.09375, \dots)$.

2. Suppose you have a continuous system, and its response is $5.23e^{-3.15t}$, and you need to find the total power used. For this, you must calculate the 2-norm squared of this continuous function. You look up the formulas

in your calculus text book, and you see that $\int_0^\infty \alpha f(t) dt = \alpha \int_0^\infty f(t) dt$ and $\int_0^\infty e^{\alpha t} dt = -\frac{1}{\alpha}$ if $\Re(\alpha) < 0$.

Additionally, you may recall from secondary school that $(e^\alpha)^2 = e^{2\alpha}$. Consequently, calculate the 2-norm of this response by calculating $\int_0^\infty (5.23e^{-3.15t})^2 dt$, which is the 2-norm squared of this continuous function.

As an engineer, you may not always understand why a particular formula works. Instead, you will be solving a problem, and you will go to your reference texts to find solutions, or you will use appropriate symbolic computation languages such as Maple.