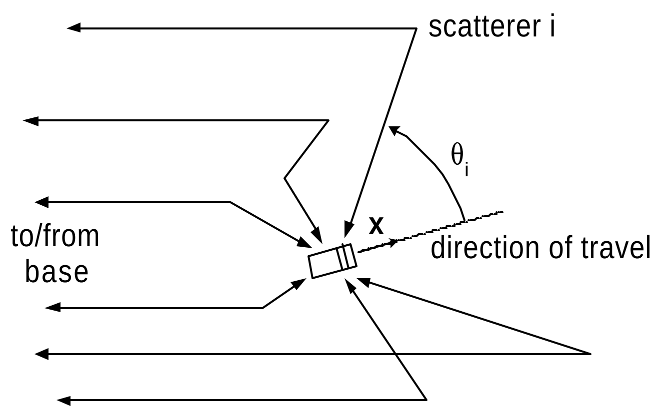
VISUALIZATION OF A RANDOM STANDING WAVE



This example illustrates a typical random spatial distribution of signal power. Assume that we have $N := 15$ rays crossing a region of space in which position is given in rectangular coordinates by the complex variable *x*. (See sketch). The angles of arrival with respect to the direction of travel and the phases at *x*=0 (a reference position) are given by

$i := 0 .. N - 1$

$\theta_i := \text{rnd}(2 \cdot \pi)$ random arrival angles $\phi_i := \text{rnd}(2 \cdot \pi)$ random phases at *x*=0

At some point *x*, the change of path length along ray *i*, compared to *x*=0, is given by

$$-\text{Re}\left(x \cdot e^{-j \cdot \theta_i}\right)$$

For convenience, use unit wavelength, so that $\lambda := 1$ and $\beta := \frac{2 \cdot \pi}{\lambda}$. Therefore the field as a function of position *x* is given by the superposition of the ray signals

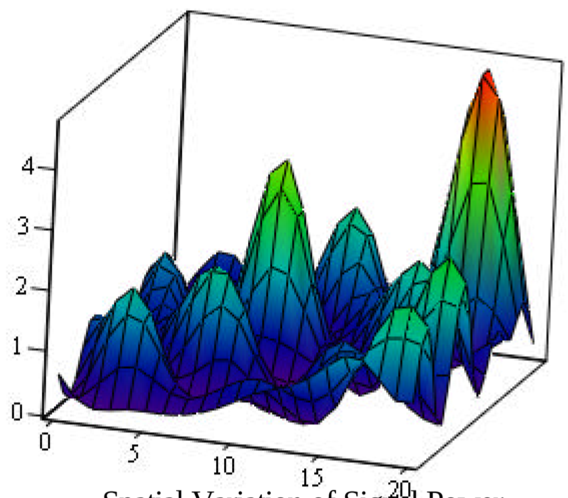
$$E(x) := \frac{1}{\sqrt{N}} \cdot \sum_i e^{j \cdot \phi_i} \cdot \exp\left(-j \cdot \beta \cdot \text{Re}\left(x \cdot e^{-j \cdot \theta_i}\right)\right)$$

To see what it looks like, we'll set up a rectangular grid 2λ x 2λ

$M := 20$ $m := 0 .. M$ $n := 0 .. M$ $x_{m,n} := 0.1 \cdot \lambda \cdot (m + j \cdot n)$

then calculate the composite signal values and their squared magnitude for the plot

$y_{m,n} := E(x_{m,n})$ $ymag_{m,n} := (|y_{m,n}|)^2$



Spatial Variation of Signal Power

ymag

Drag this surface around to different orientations with your mouse.

This is only a 2λ x 2λ patch, so you can imagine the rapid fluctuations in signal strength experienced by the mobile as it drives through.

You can see quasiperiodicity (i.e., it's similar to, but not quite, periodic behaviour).

If you want to see other sample functions, go back up to the equations for ϕ and θ and recalculate them (put the cursor on them and press F9) and view the plots again. Alternatively, just go the menu bar and select Math/Calculate Worksheet.