# Random surface

Rectangular area $L_x, L_y$ lattice $N$ sites $= N_x N_y$
coordinate sites $x(i), y(i)$ $i = 1, N$ $dx, dy$ lattice spacing

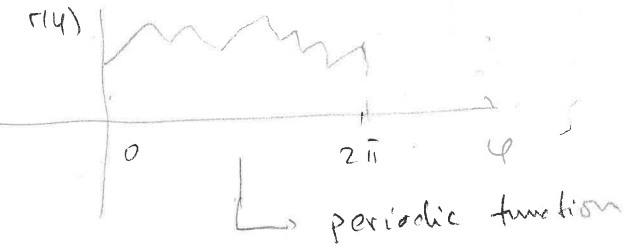
island:

$$r(\varphi) = r_0 + \sum_{k=1}^{n} r_k \left[\sin(k b_k \varphi + \varphi_k)\right]^2 \left[1 - e^{(\varphi - 2\pi)}\right] + e^{(\varphi - 2\pi)} \left[r(0) - r_0\right] \Rightarrow r(0) = r(2\pi)$$

in program: $r_k = amp(k,i)$, $b_k = frk(k,i)$ $i$ = island $i$

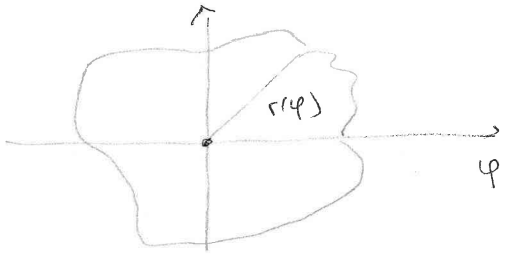
$r_k, b_k, \varphi_k$ random parameters

$\varphi_k \in (0, 2\pi)$

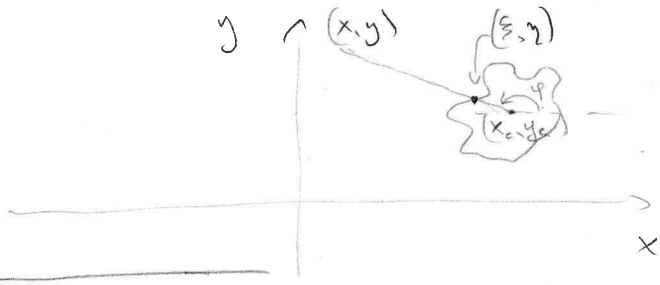



$\in (amp - v, amp + v)$

$b_k$ = frequency factor



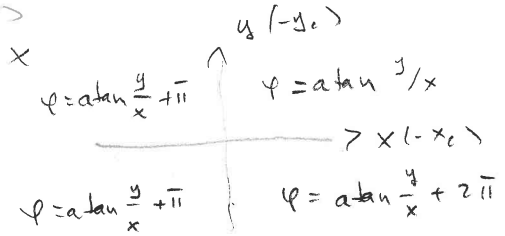

On the lattice:




$x_c, y_c$ centre of island

$$d = \sqrt{(x - x_c)^2 + (y - y_c)^2}$$

$$\varphi = atan2\ \frac{y - y_c}{x - x_c}$$




$-\pi/2 < atan\ t < \pi/2$

Translate $\varphi$ to interval $(0, 2\pi)$

$\xi = r(\varphi) \sin\varphi \quad \eta = r(\varphi) \cos\varphi$

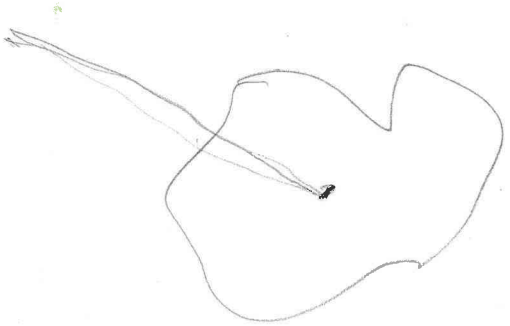
if $d < r(\varphi)$ then $x \in$ island

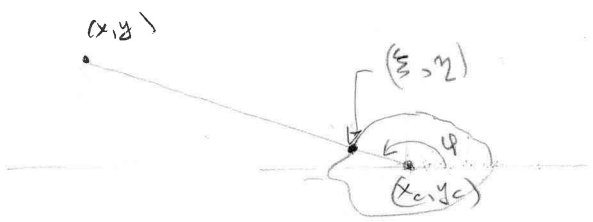
in order to avoid singularities of $atan\ \frac{y - y_c}{x - x_c}$ when $x = x_c$

chose $x_c, y_c$ slightly away from a lattice point with a small random shift within $dx, dy$

Also, add a rotation angle of each island to avoid a biased alignement along x

$f(\varphi)$

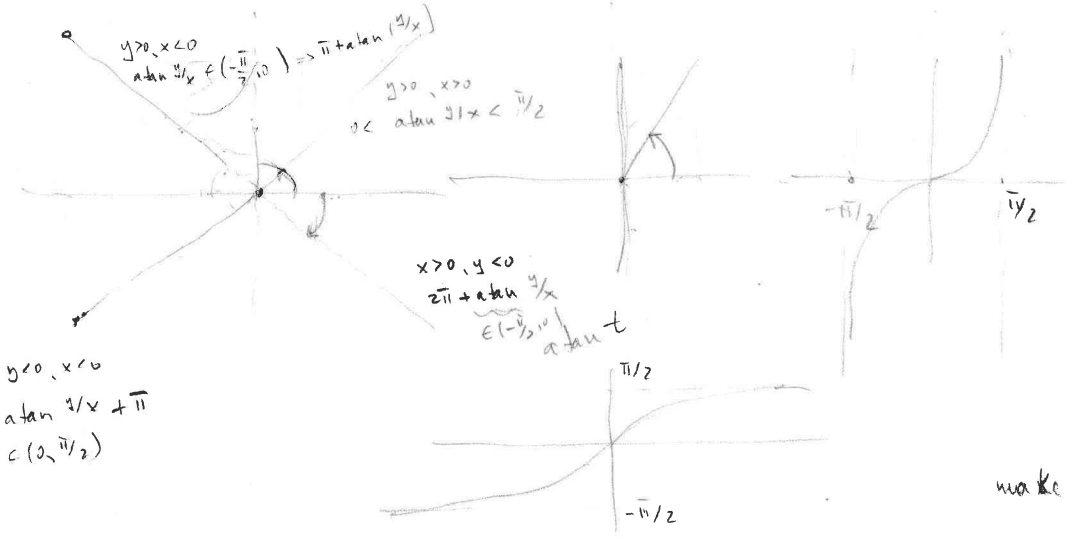





$$\xi = r\cos(\varphi + \varphi_0)$$
$$\eta = r\sin(\varphi + \varphi_0)$$
$$S = \sqrt{(\xi - x_c)^2 + (\eta - y_c)^2}$$

fix site $\Rightarrow x, y$

calc $d = \sqrt{(x-x_c)^2 + (y-y_c)^2}$ $\quad \varphi = \operatorname{atan}\frac{y-y_c}{x-x_c}$




make function $r(\varphi)$

$\Rightarrow \varphi$ $\qquad d < r(\varphi) \Rightarrow$ color = 1

unusual color map

↳ here add $\varphi_0$ to rotate the island