FOURIER DESCRIPTORS

$$U(n) \equiv X(n) + jY(n) \quad n=0,1,\ldots, N-1$$

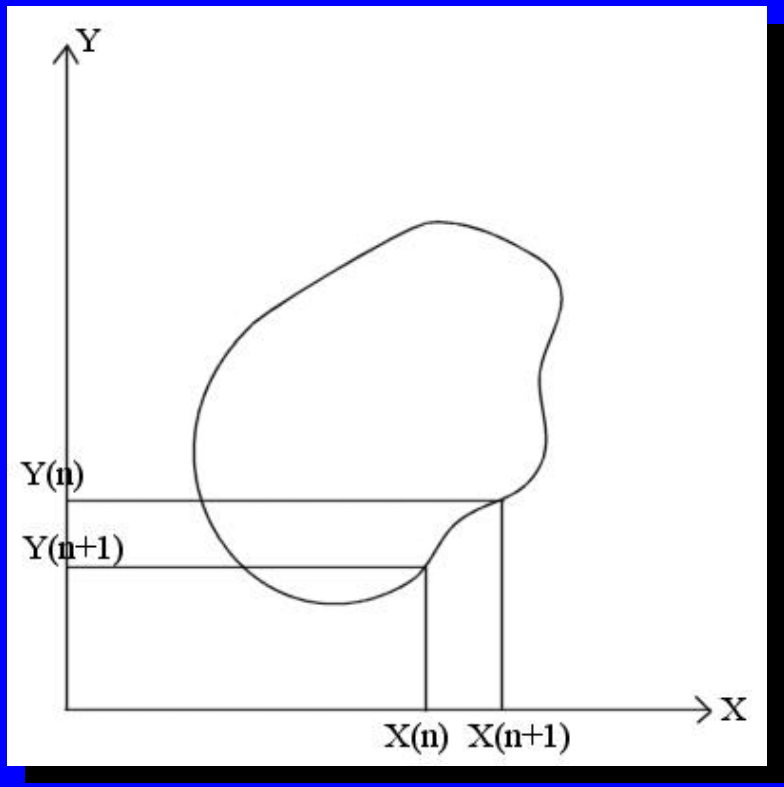
DFT: $$U(n) \equiv \sum_{k=0}^{N-1} a(k) \exp\left(\frac{j2\pi kn}{N}\right)$$

$$a(k) \equiv \sum_{n=0}^{N-1} U(n) \exp\left(\frac{-j2\pi kn}{N}\right)$$

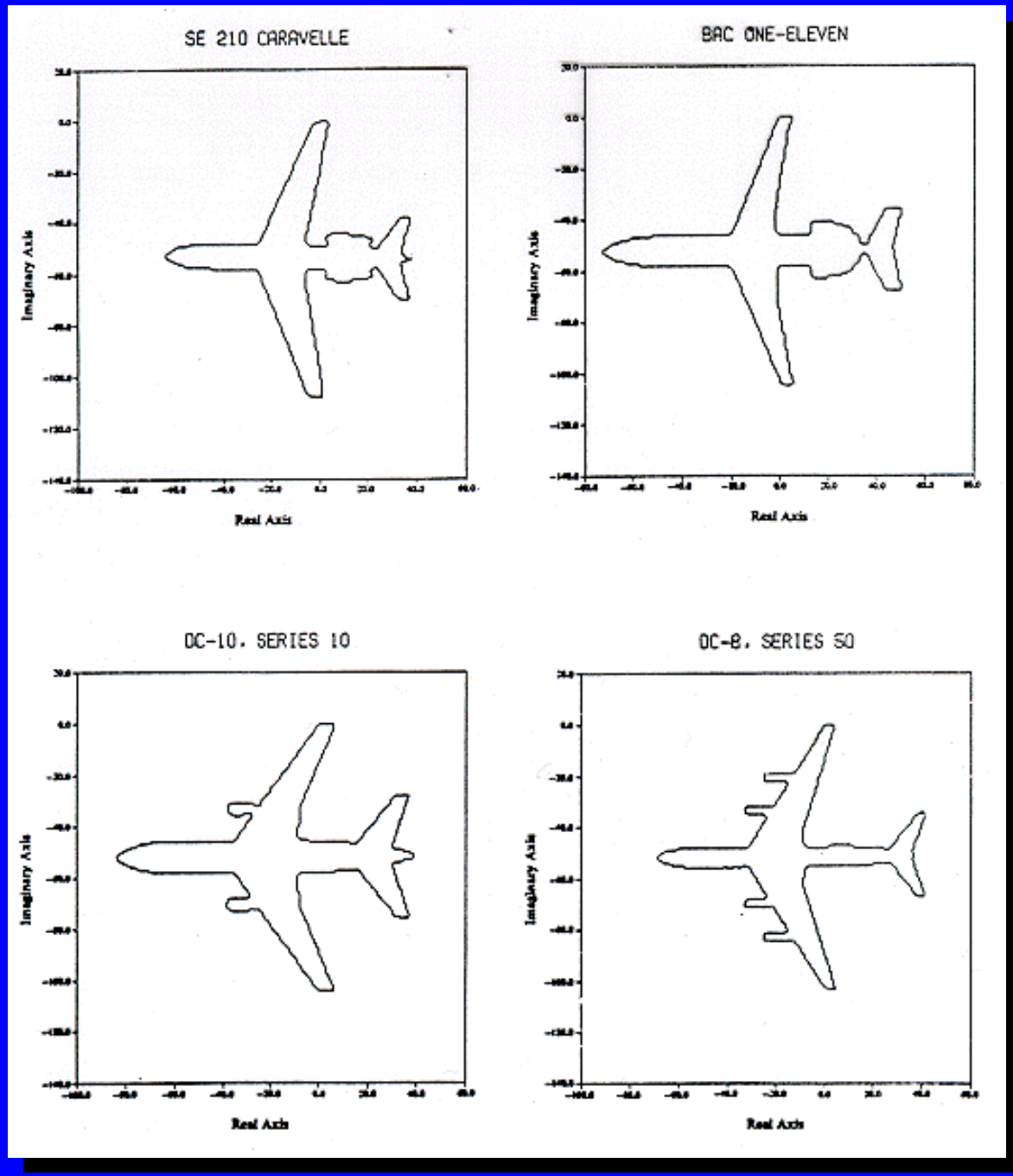
R □ Roughness $$\equiv \sqrt{\sum_{k=0}^{N-1} |a(k)|^2}$$

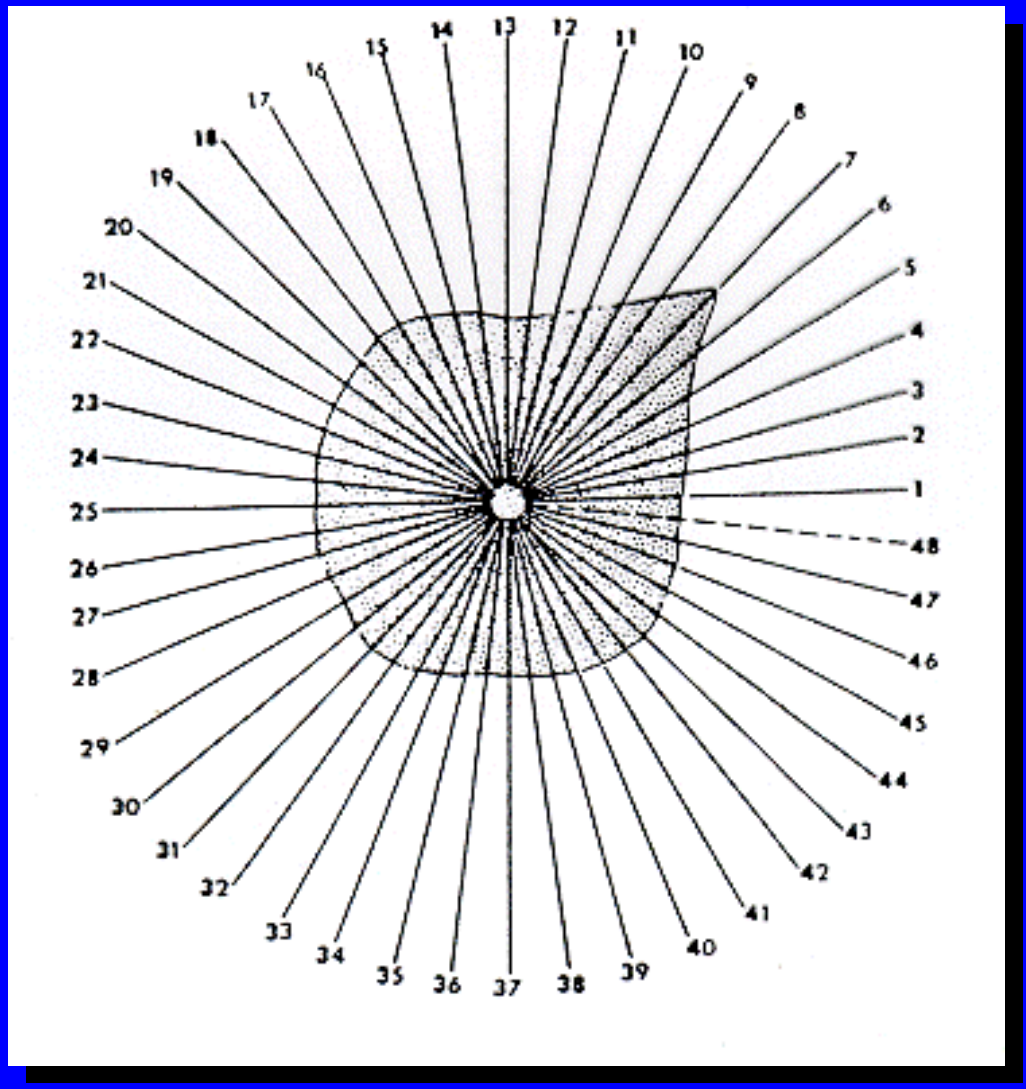
R_M □ Modified roughness $$\equiv \sqrt{\sum_{k=0}^{M} |a(k)|^2}$$

(closed boundary $\Rightarrow$ U(n) periodic)



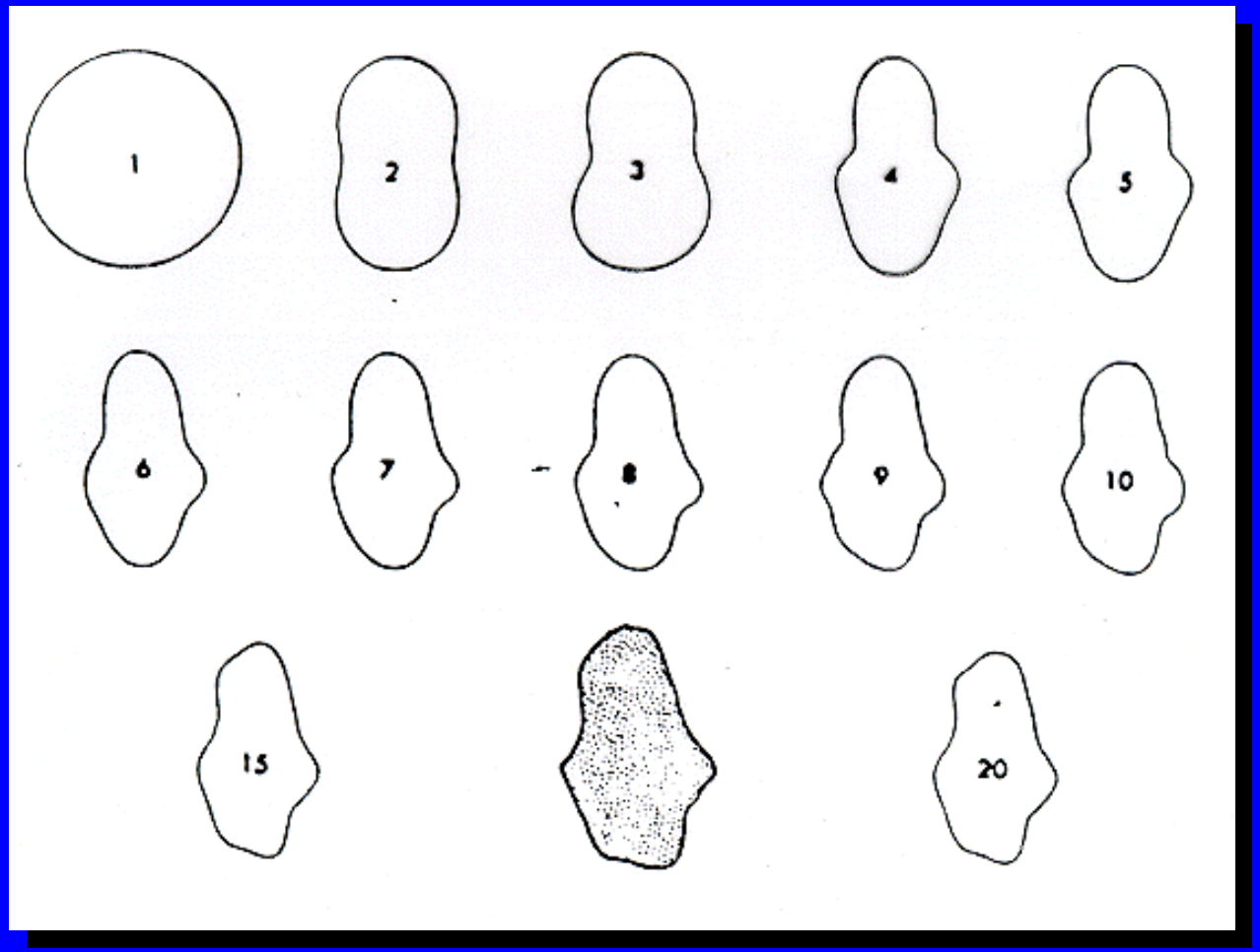
512 coordinates,
32 harmonics:

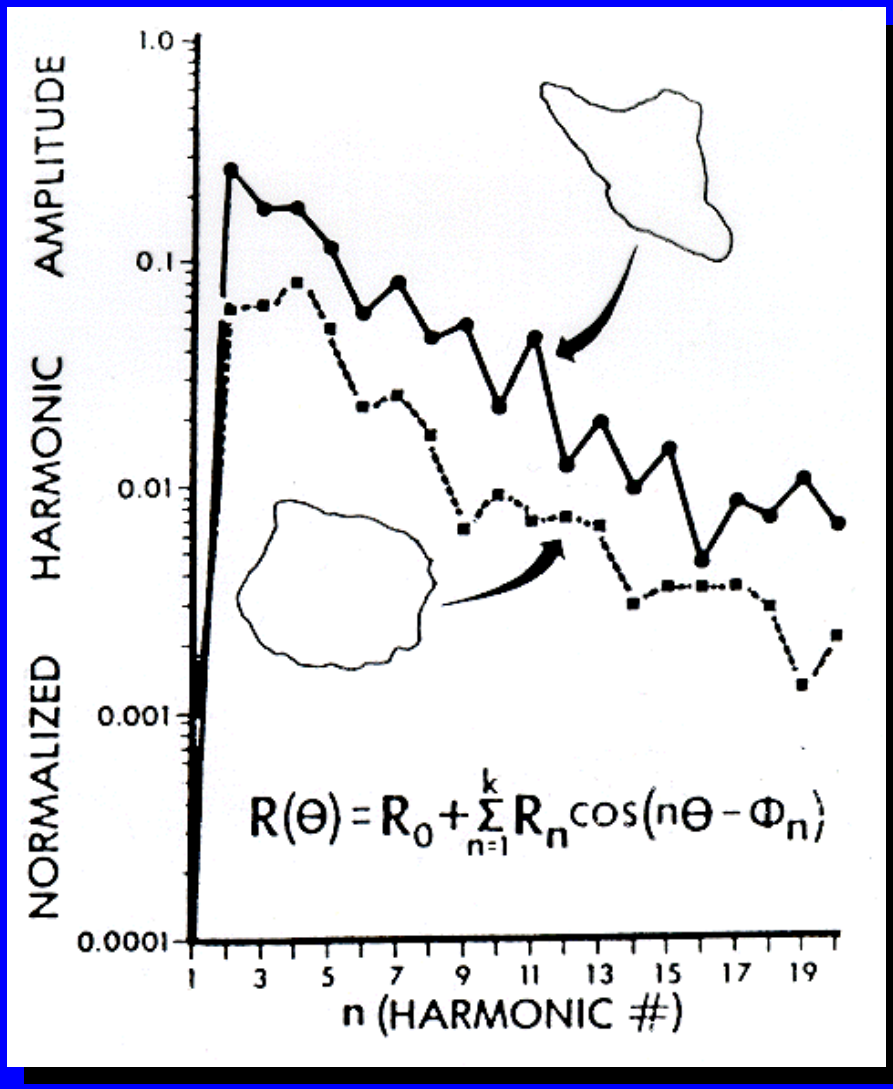


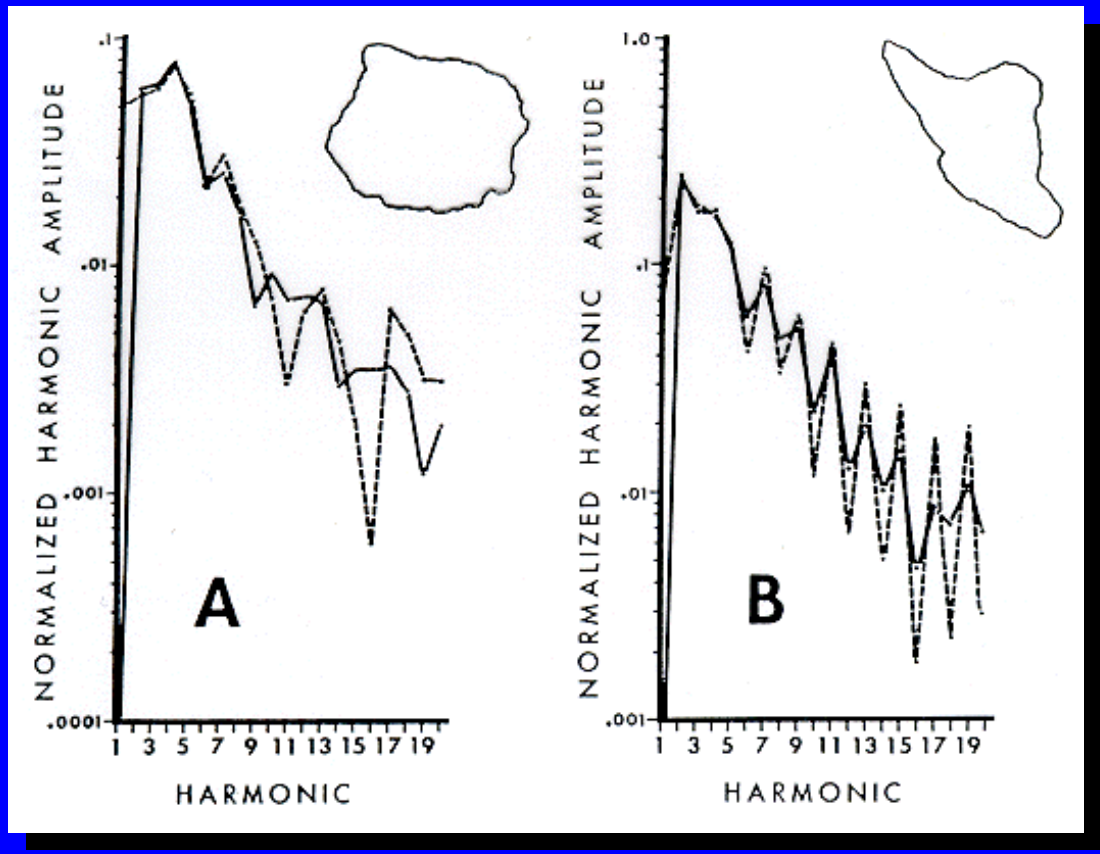


$$R(\theta)=R_0+\sum_{n=1}^{k} R_n \cos(n\theta-\Phi_n)$$

The coefficients R_n are called Fourier descriptors


1
2
3
4
5
6
7
8
9
10
15
20


NORMALIZED HARMONIC AMPLITUDE
1.0
0.1
0.01
0.001
0.0001
1 3 5 7 9 11 13 15 17 19
n (HARMONIC #)
$R(\theta) = R_0 + \sum_{n=1}^{k} R_n \cos(n\theta - \Phi_n)$


NORMALIZED HARMONIC AMPLITUDE
.1
.01
.001
.0001
A
1 3 5 7 9 11 13 15 17 19
HARMONIC
NORMALIZED HARMONIC AMPLITUDE
1.0
.1
.01
.001
B
1 3 5 7 9 11 13 15 17 19
HARMONIC