

# Gagan Mirchandani-Professor

## ■ Teaching

Signal Processing, Image Processing, Wavelets

## ■ Research

\* Multidimensional, multiresolution signal processing

\* Current Project Summary\*

- Atrial Fibrillation is a common arrhythmia caused by irregular electrical activity in the heart.

**Goal:** To map conduction of electrical activity in the heart to aid in procedures for destroying diseased tissue.

- We use Spectral Analysis to automate the determination of local activation time.
- We use Morphology Analysis to characterize the mechanism of AF.

\* with Dr. Peter Spector, Cardiology, College of Medicine , UVM and Ms. Shruti Sharma, School of Engineering, UVM.

# Spectral Analysis of Atrial Fibrillation Electrograms



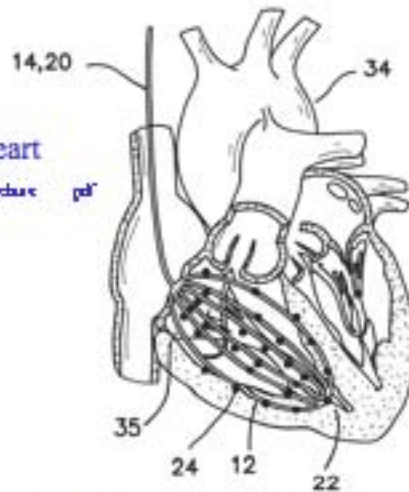
Conduction in a Normal Heart

[lap/#www](#) [brazs/lypbc/fundamen](#) [a/gte-fbr/ovw@ardua.c](#) pdf



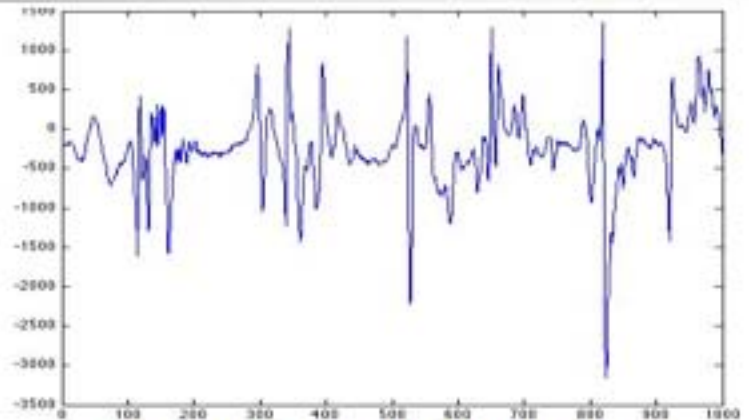
Conduction with Atrial Fibrillation

[lap/#www](#) [brazs/lypbc/fundamen](#) [a/gte-fbr/ovw@ardua.c](#) pdf

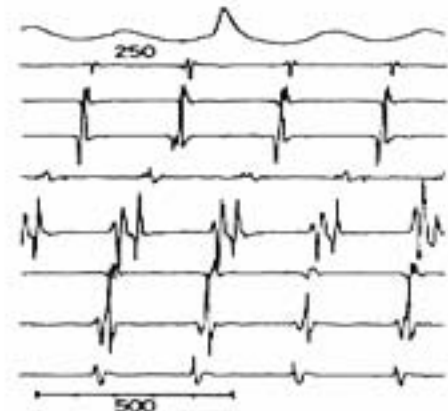


Simultaneous Mapping of the Atrium using a Basket Catheter at 38 points.

Courtesy [lap/#www](#) [freqspectrum.com](#) [case6732655.html](#)



Intra-Cardiac Electrogram from the Right Atrium using a Basket Catheter

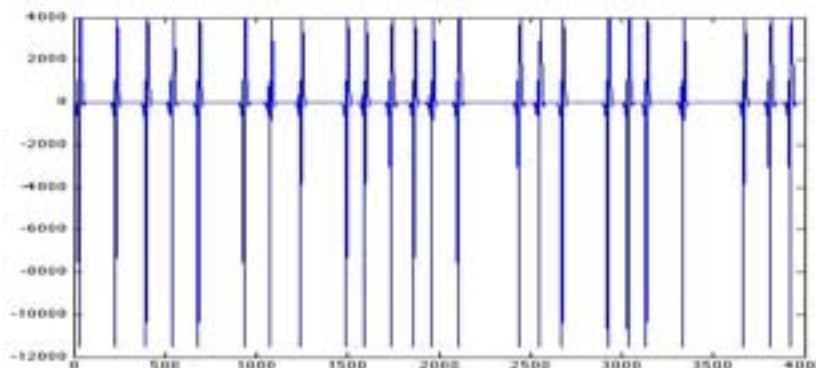


Electrograms from Consecutive Points show the Direction of Conduction

Courtesy [lap/#www](#) [freq.org](#) [a/gte-fbr/ovw@ardua.c](#)

# Results - Activation times

Synthetic non-stationary electrocardiogram signal



Actual event frequency

5	6	7	7	4	7	6	4	10	7	8	10	7	3	9	8	4	9	10	5	3	7	9
4	8	7	7	4	7	6	3	7	8	10	7	3	9	8	3	9	10	4	3	9	9	9

Calculated event frequency  
(New method)

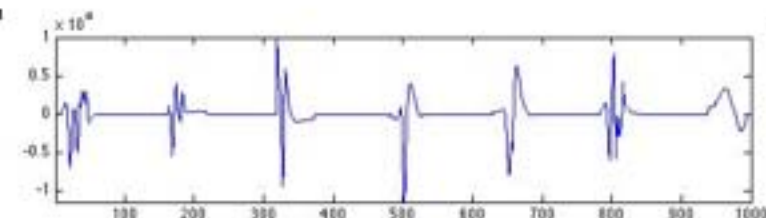
Comparing Average Frequencies:

Ground Truth - 6.73Hz

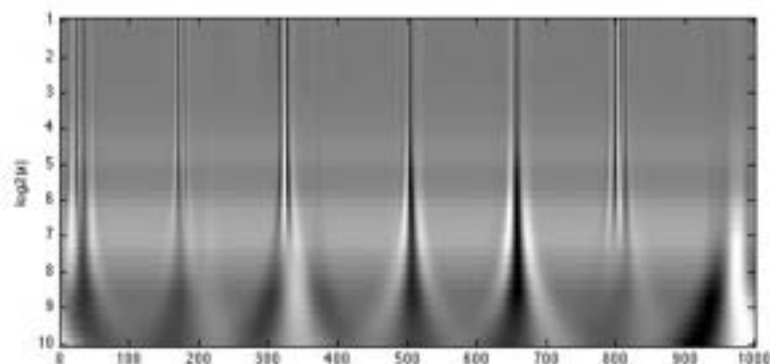
Using State of the Art - 7.75Hz (Cannot do event frequency)

New Method - 6.69Hz

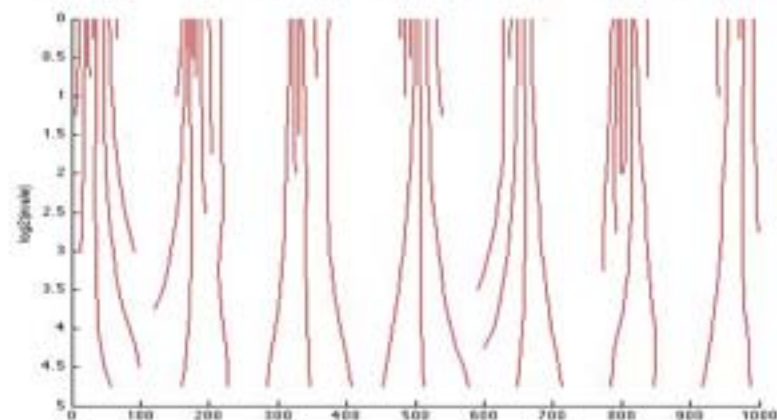
# Results - Morphology Analysis



Electrocardiogram signal



Characterizing morphologies through singularities with a wavelet transform



Measuring singularities through wavelet transform modulus maxima and Lipschitz exponents