

# Lecture 2 Image Formation

COMP3204 & COMP6223 Computer Vision

**What is inside an image?**

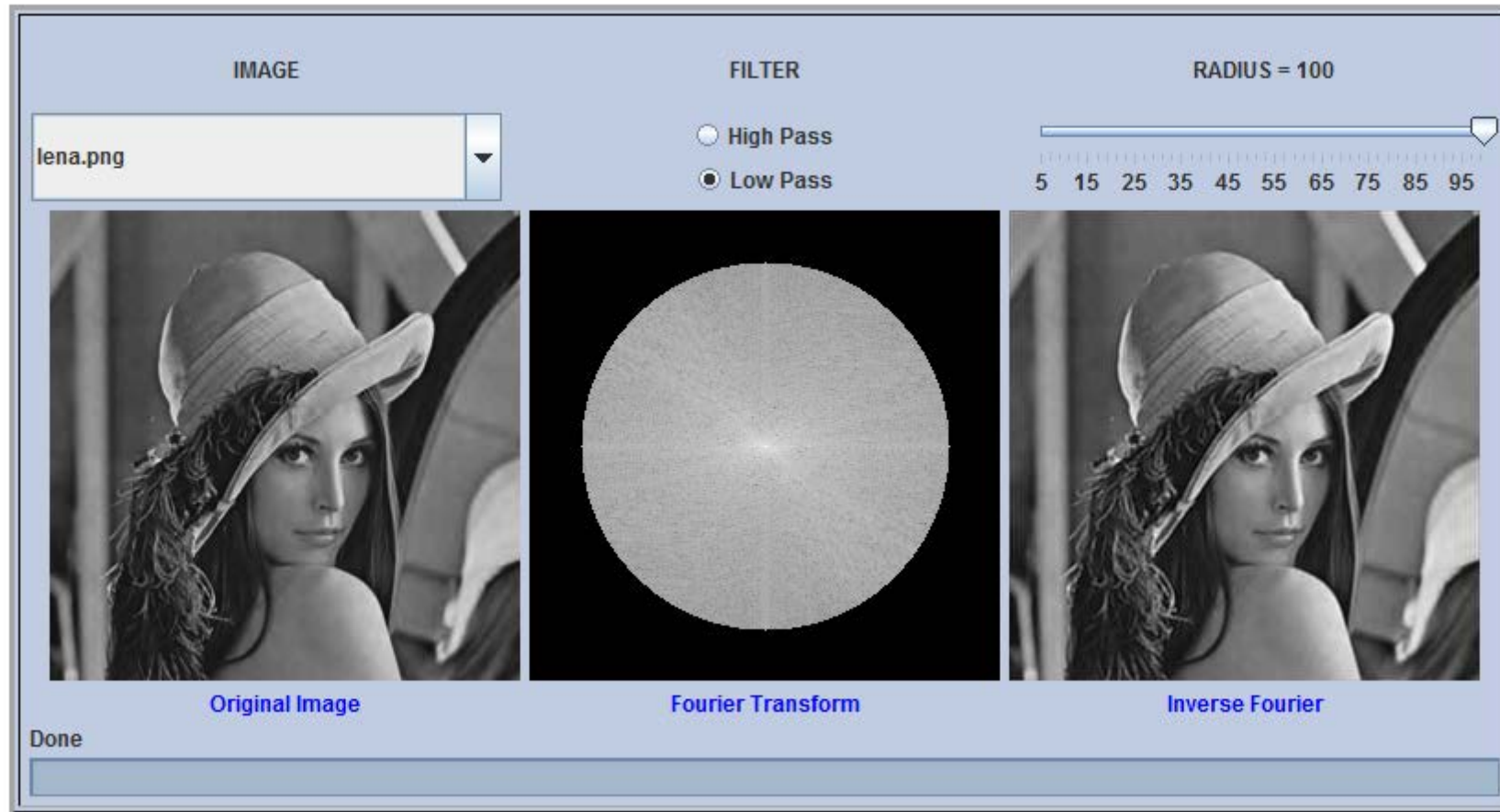


**Book  
pp  
37-45**

**Department of  
Electronics and  
Computer Science**

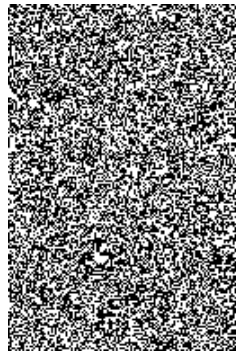
**UNIVERSITY OF  
Southampton**  
School of Electronics  
and Computer Science

[http://users.ecs.soton.ac.uk/msn/book/new\\_demo/fourier/](http://users.ecs.soton.ac.uk/msn/book/new_demo/fourier/)





(a) original image



(b) bit 0 LSB



(c) bit 1



(d) bit 2



(e) bit 3



(f) bit 4



(g) bit 5



(h) bit 6



(i) bit 7 MSB

**Decomposing an Image Into its Bits**



(a)  $64 \times 64$



(b)  $128 \times 128$



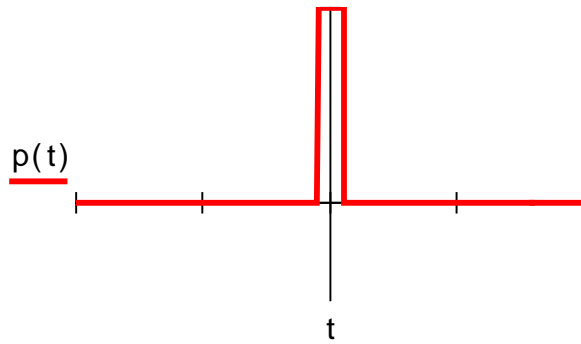
(c)  $256 \times 256$

**Effects of Differing Image Resolution**

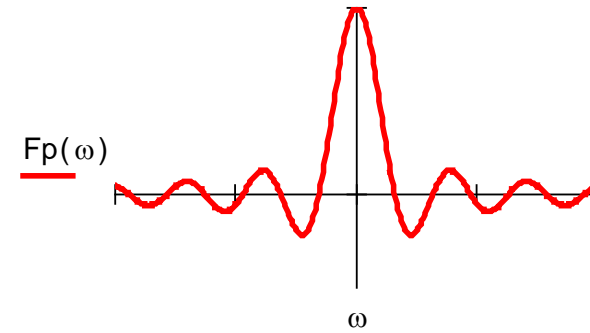
# Jean Baptiste Joseph Fourier

- Any periodic function is the result of adding up sine and cosine waves of different frequencies
- Sceptical? Yeah, so were Lagrange and Laplace. Good company eh?
- “Fourier’s treatise is one of the very few scientific books that can never be rendered antiquated by the progress of science”  
James Clerk Maxwell 1878
- Fourier 10 Laplace 0 ...





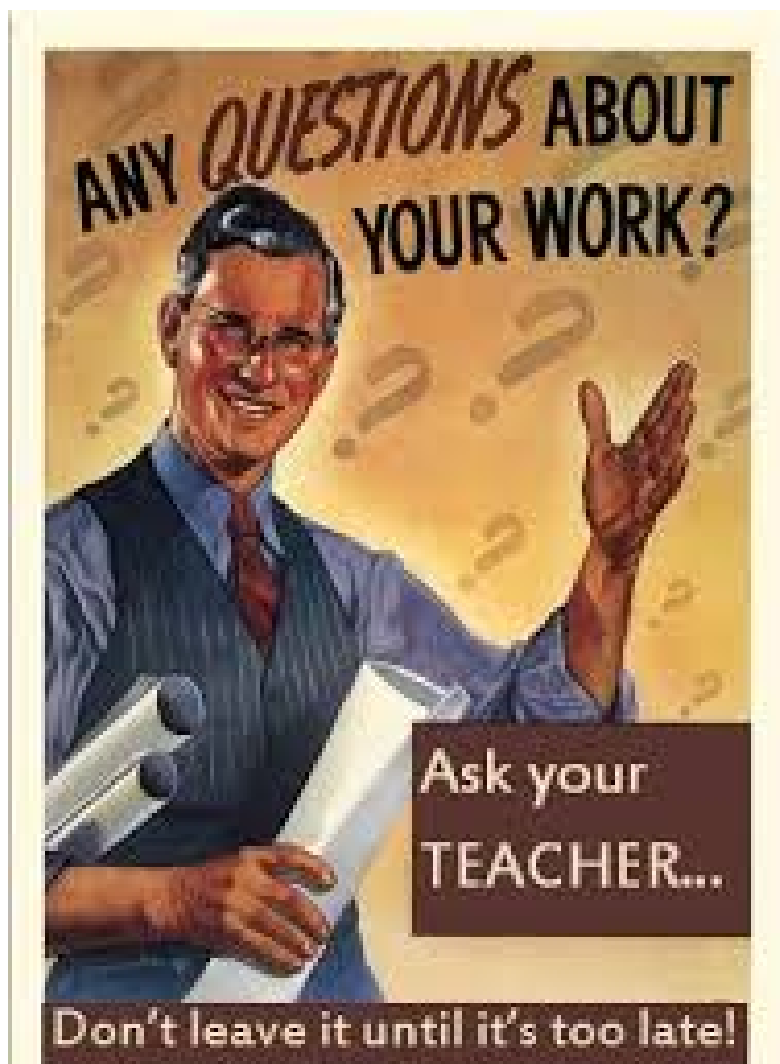
**(a)** pulse of amplitude  $A = 1$



**(b)** Fourier transform

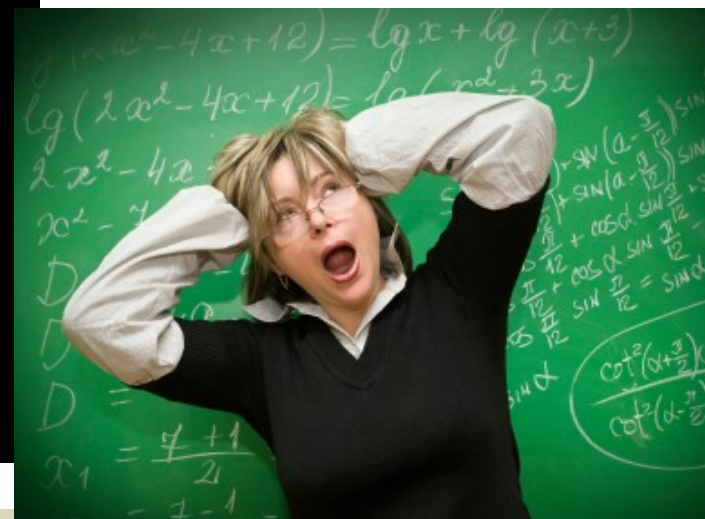
## A Pulse and its Fourier Transform

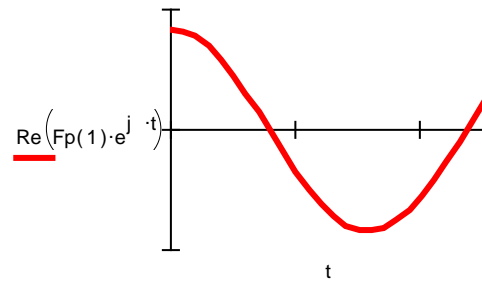
# Google “are you frightened of maths”



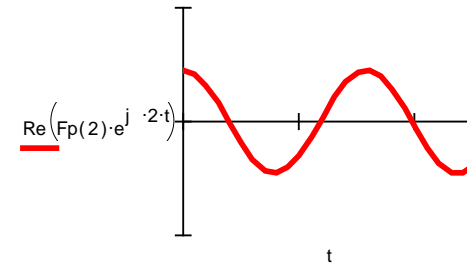
$2+2=\text{fish}$   
 $3+3=\text{eight}$   
 $7+7=\text{triangle}$

Only smart people would get this.

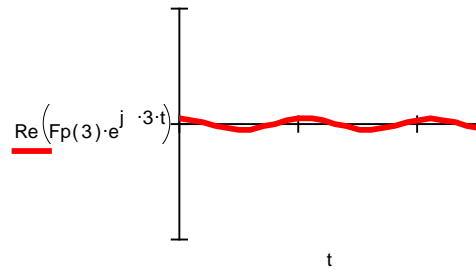




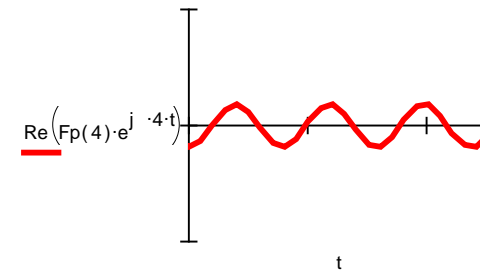
**(a)** contribution for  $\omega = 1$



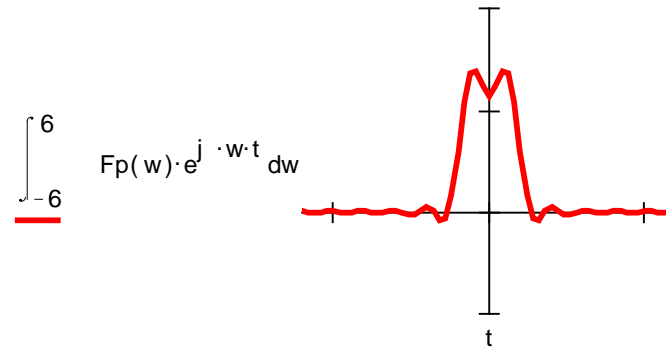
**(b)** contribution for  $\omega = 2$



**(c)** contribution for  $\omega = 3$



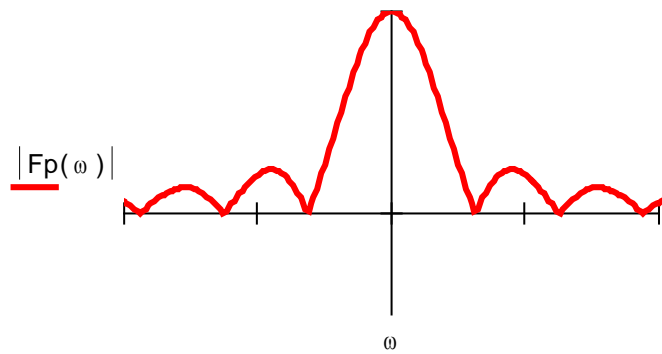
**(d)** contribution for  $\omega = 4$



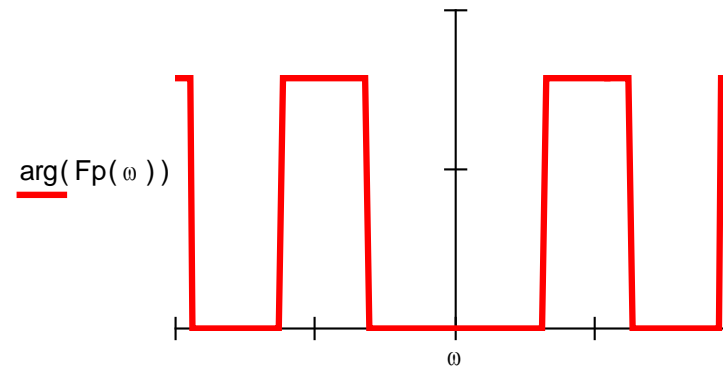
**(e)** reconstruction by integration

**Reconstructing a Signal from its Transform**





**(a)** magnitude



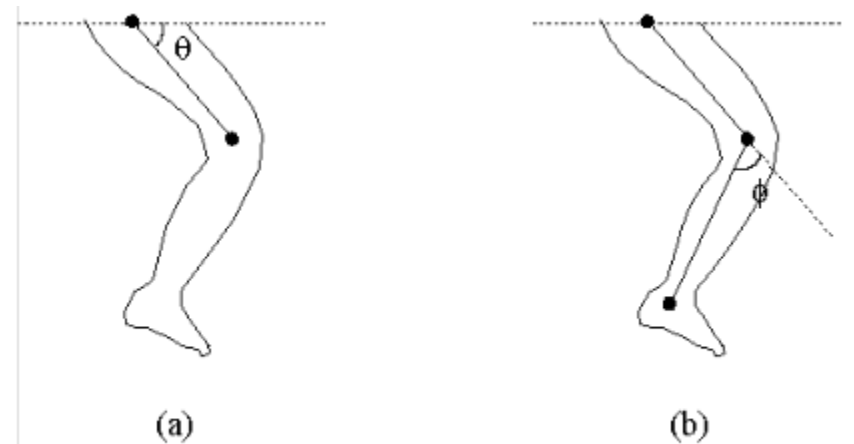
**(b)** phase

**Magnitude and Phase of Fourier Transform of Pulse**

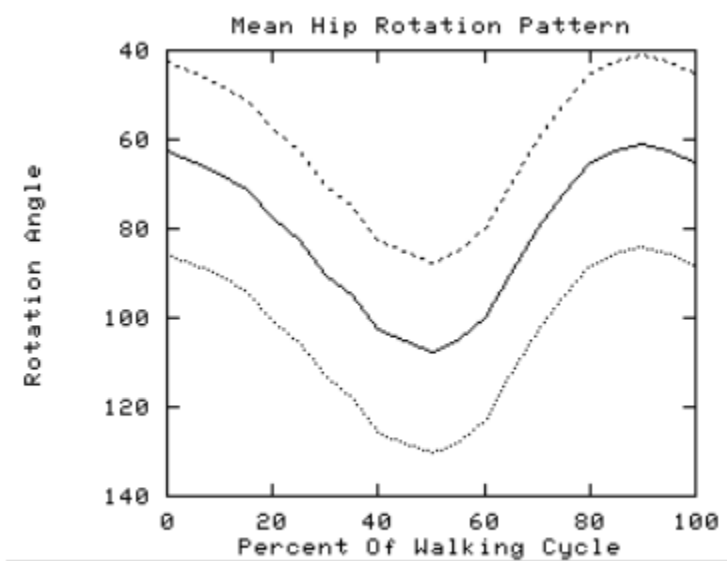
# Using Gait as a Biometric, via Phase-Weighted Magnitude Spectra

David Cunado, Mark S. Nixon and John N. Carter

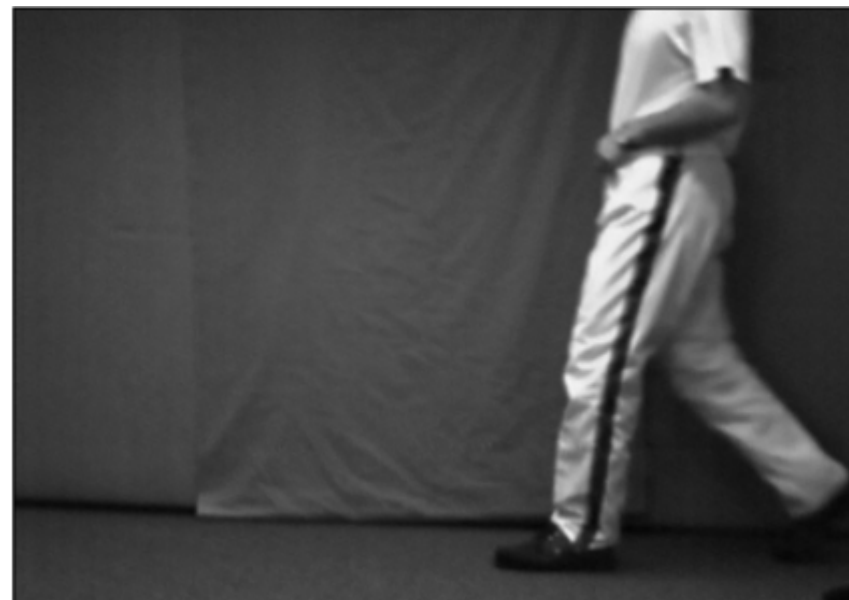
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Email: dc95r@ecs.soton.ac.uk and msn@ecs.soton.ac.uk



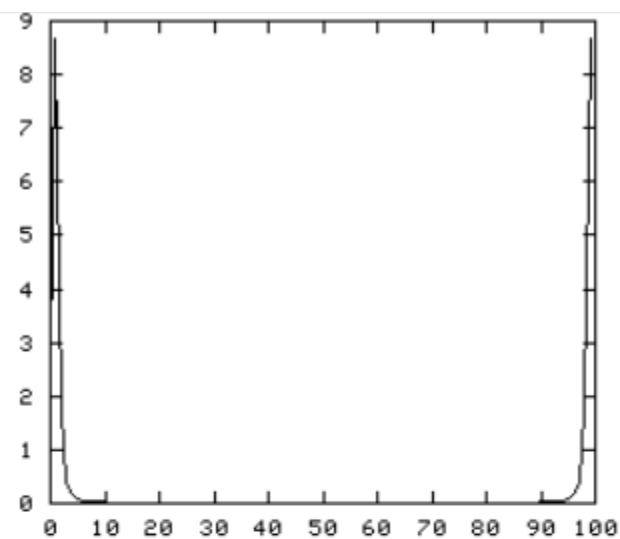
**Fig. 1.** (a) Hip and (b) Knee rotation angles.



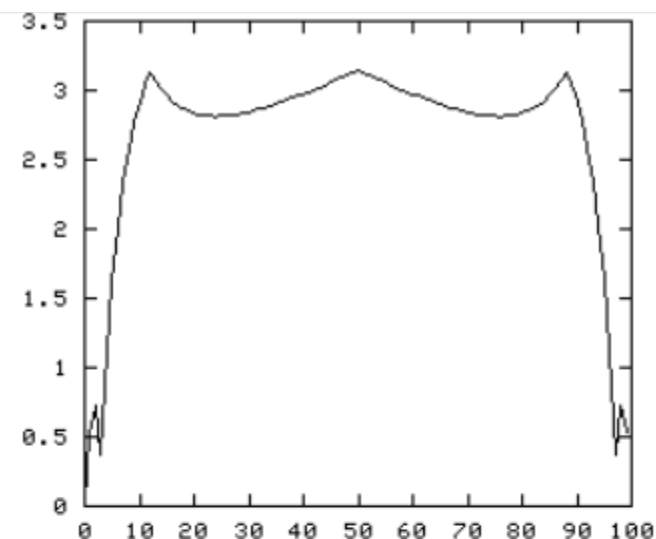
**Fig. 2.** Variation in Hip Rotation.



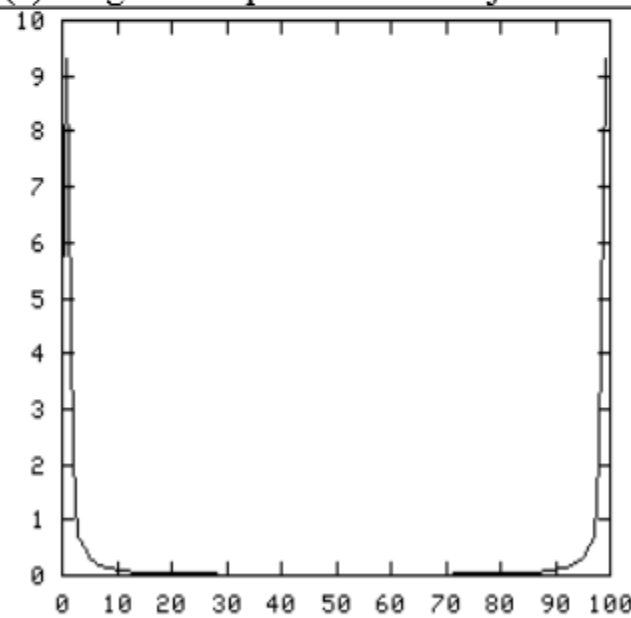
**Fig. 3.** Example Image of Walking Subject.



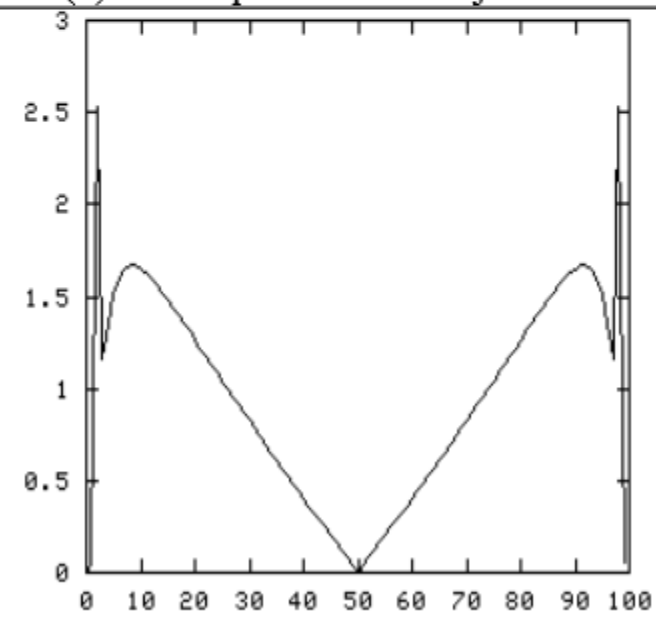
(a) Magnitude spectrum for subject 2.



(b) Phase spectrum for subject 2.



(c) Magnitude spectrum for subject 5.



(d) Phase spectrum for subject 5.

**Fig. 6.** Phase and Magnitude Gait Spectra.