

Μετασχηματισμός Φουριέ Διακριτού Χρόνου

Σήμα z ($z(0)$, $z(1)$, ... $z(N-1)$) N διαδοχικές τιμές

Βάση Φουριέ Στοιχειώδεις συχνότητες

Φ_m : ($\Phi_m(0)$, $\Phi_m(1)$, ... $\Phi_m(N-1)$) $m = 0, \dots, N-1$

$$\Phi_m(n) = 1/N e^{(2\pi i n/N)m}$$

Φ_m είναι ιδιοσυναρτήσεις των γραμμικών συστημάτων:

$$A(\Phi_m) = \lambda_m \Phi_m$$

Συντελεστές Φουριέ του z

($(Fz)(0)$, $(Fz)(1)$, ... $(Fz)(N-1)$)

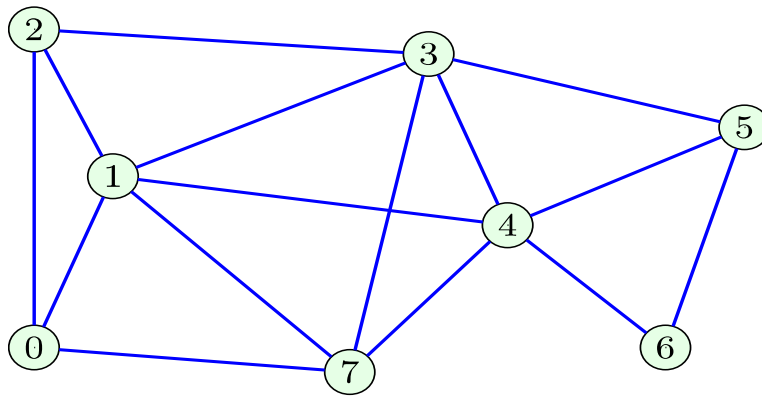
$$(Fz)(m) = \sum_{n=0, \dots, N-1} z(n) e^{-2\pi i n/N m} \quad m = 0, \dots, N-1$$

Αντίστροφος μετασχηματισμός Φουριέ

$$z = \sum_{m=0, \dots, N-1} (Fz)(m) \Phi_m$$

$$A(z) = \sum_{m=0, \dots, N-1} \lambda_m (Fz)(m) \Phi_m$$

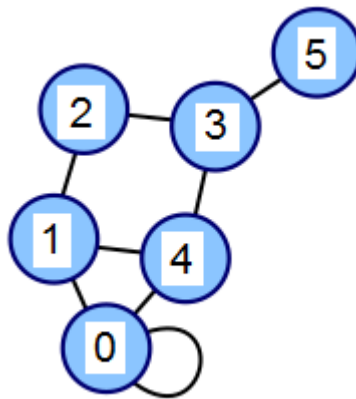
Γράφημα G



Μητρώο γειτνίασης του G

$$\mathbf{A} = \begin{matrix} 0 \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 6 \\ 7 \end{matrix} \begin{bmatrix} 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 1 & 0 & 0 & 0 \end{bmatrix}$$

0 1 2 3 4 5 6 7

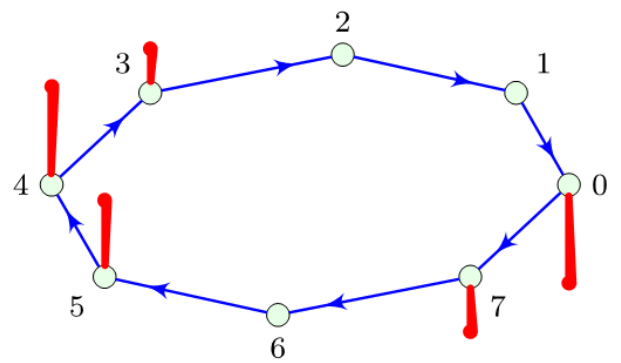
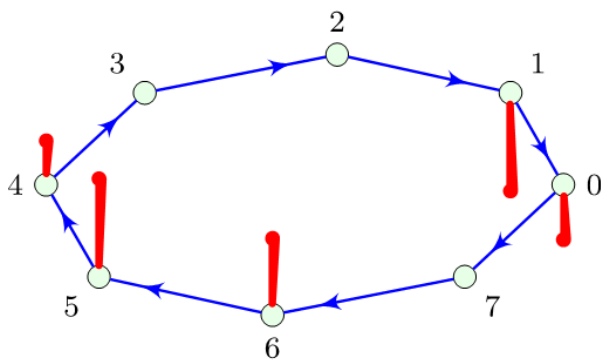
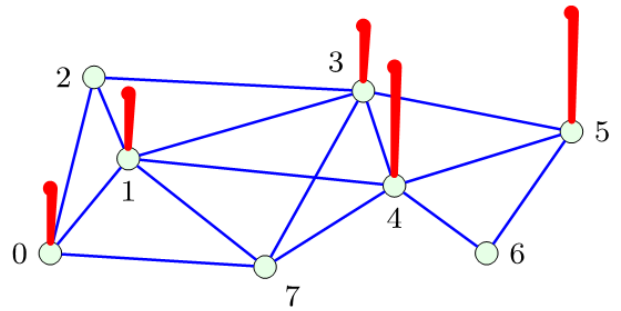
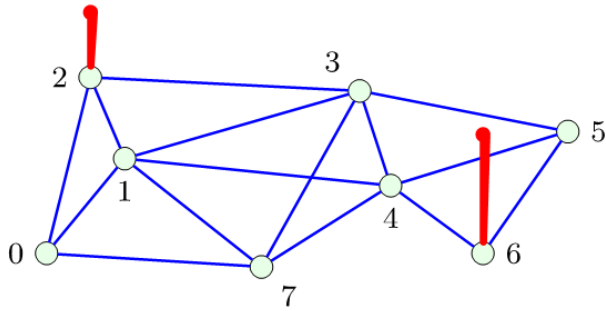


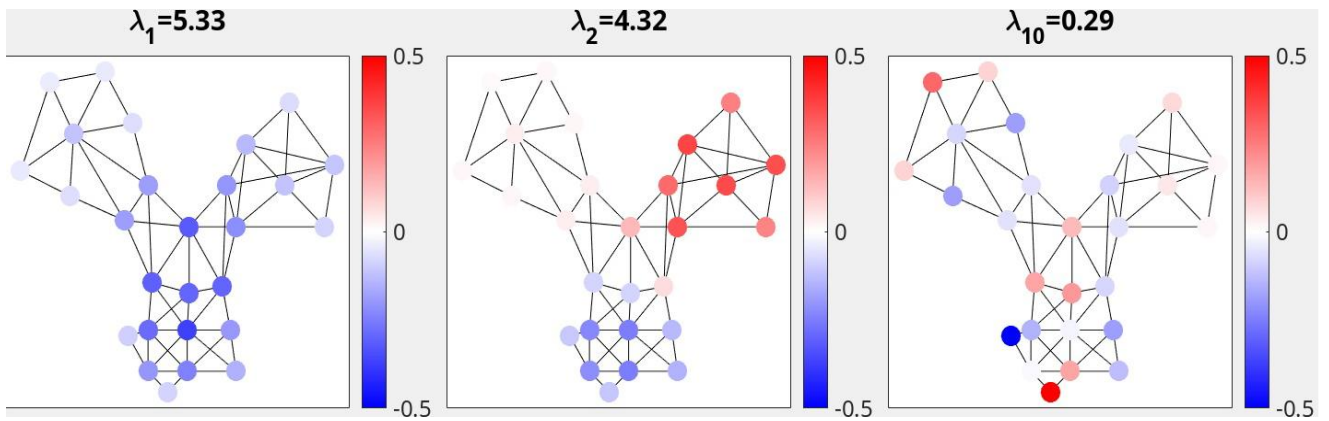
$$A\mathbf{x} = \begin{pmatrix} 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \end{pmatrix} \begin{bmatrix} x_0 \\ x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix}$$

$$= \begin{bmatrix} x_0 + x_1 + x_4 \\ x_0 + x_2 + x_4 \\ x_1 + x_3 \\ x_2 + x_4 + x_5 \\ x_0 + x_1 + x_3 \\ x_3 \end{bmatrix}$$

Ολίσθηση γραφήματος

Graph Shift



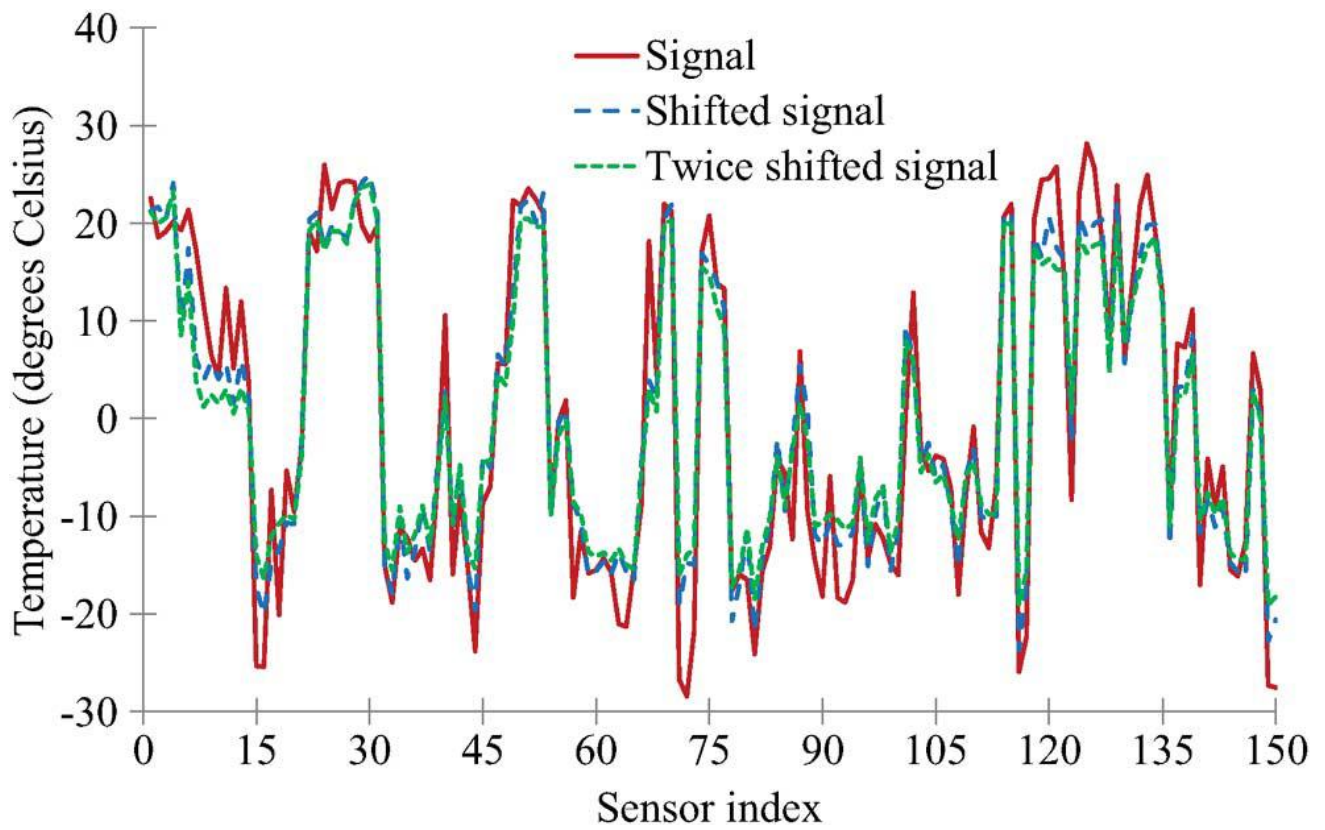


Example of elementary frequencies obtained from representations of the graph by its *Adjacency matrix*

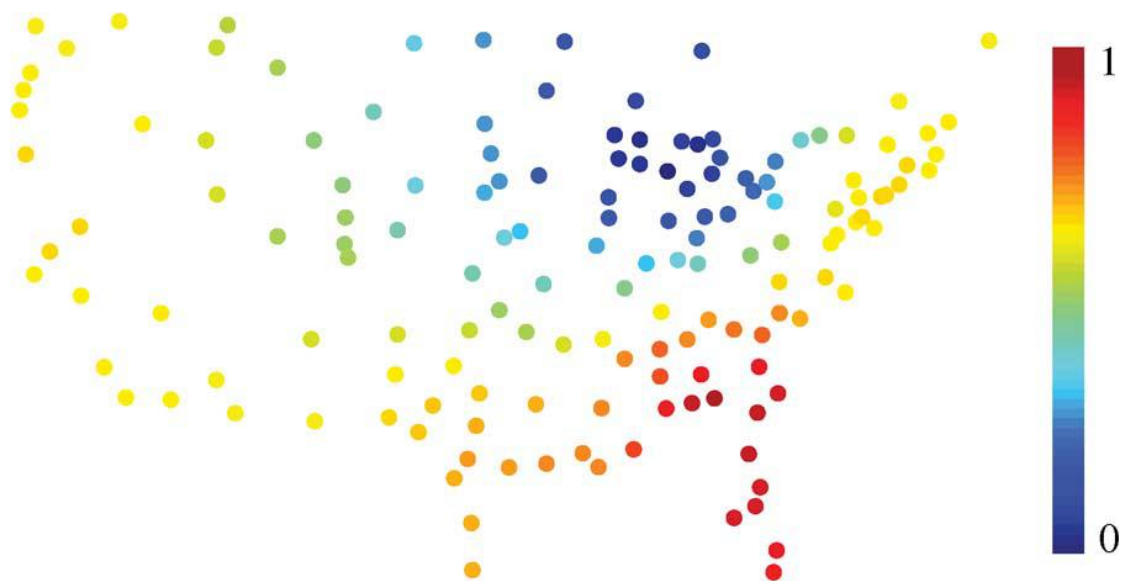
Three different frequencies are shown, corresponding to different eigenvalues

Graph Signal Processing: Overview, Challenges and Applications

A. Ortega, P. Frossard, J. Kovacevic, J.M.F. Moura, P. Vandergheynst



A signal representing temperature measurements from $N = 150$ sensors. Shifting the signal produces signals similar to the original.



The Fourier basis vector that captures most energy of temperature measurements

Discrete Signal Processing on Graphs

A. Sandryhaila, J. M. F. Moura