7.4 Is the two-band subband coding filter bank containing filters $h0(n) = \{1/\sqrt{2}, 1/\sqrt{2}\}$, $h1(n) = \{-1/\sqrt{2}, 1/\sqrt{2}\}$, $g0(n) = \{1/\sqrt{2}, 1/\sqrt{2}\}$, $g1(n) = \{1/\sqrt{2}, -1/\sqrt{2}\}$ orthonormal, biorthonormal, or both?

7.9 (a) Compute the Haar transform of the 2×2 image

$$F = \begin{bmatrix} 3 & -1 \\ 6 & 2 \end{bmatrix}$$

(b) The inverse Haar transform is $F=H^TTH$, where T is the Haar transform of F and H^T is the matrix inverse of H. Show that $H_2^{-1} = H_2^T$ and use it to compute the inverse Haar transform of the result in (a).

7.12 Write an expression for scaling space V3 as a function of scaling function $\varphi(x)$. Use the Haar scaling function definition of Eq. (7.2-10) to draw he Haar V3 scaling functions at translations k={0,1,2}.

7.20 The computational complexity of an M-point FWT is O(M). That is, the number of operations is proportional M. What determines the constant of proportionality?

7.23 Compute the two-dimensional wavelet transform with respect to Haar wavelets of the 2×2 image in Problem 7.9. Draw the required filter bank and label all inputs and outputs with the proper arrays.