Weekly Status Report

Development of a 1D Adaptive Wavelet Collocation Code
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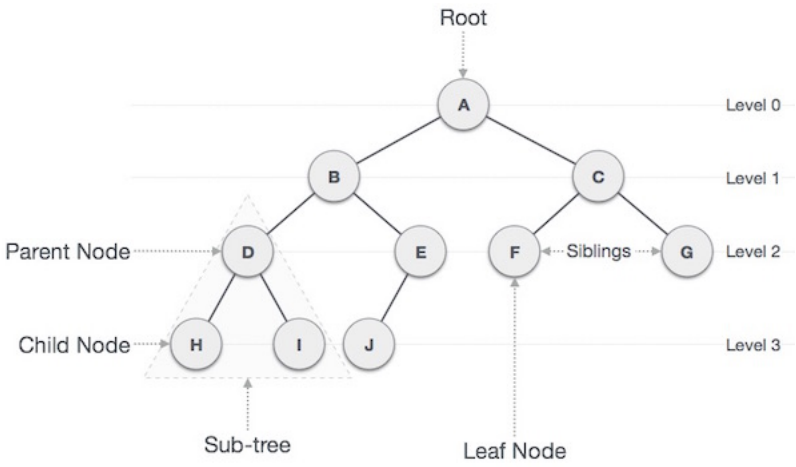
Week Beginning 8/21/03

1 Summary of efforts from last week

1. Completed codes to construct second-generation interpolating wavelets. Both the scaling functions $\phi_m^J(x)$ and the detail wavelet functions $\psi_m^J(x)$ can be constructed to an arbitrarily high level of resolution, J. This is done using the interpolating subdivision scheme based on Deslauriers & Dubuc 1989.

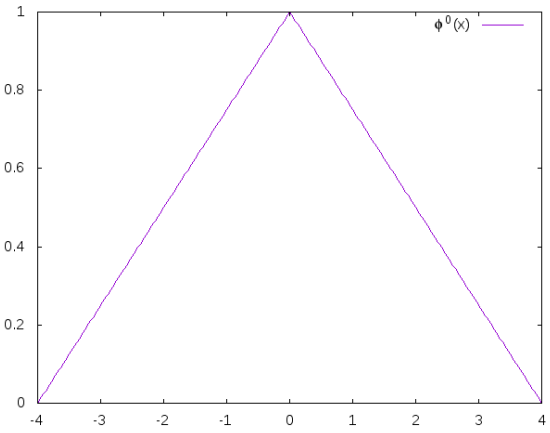
2. Investigated binary search tree algorithms for dynamic allocation of dyadic grid information.



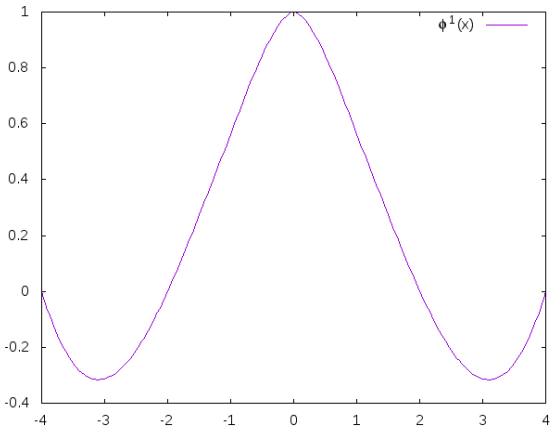
2 This week's goals

1. To use the scaling and detail wavelet functions, in conjunction with the forward wavelet transform, to approximate some initial function $u(x)$. A function $u(x)$ may be approximated by

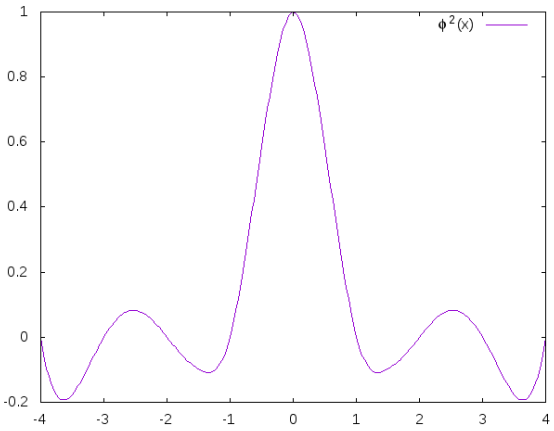
$$u^J(x) = \sum_{k \in \mathcal{K}'} c_k^0 \phi_k^0(x) + \sum_{j=0}^{J-1} \sum_{l \in \mathcal{L}^j} d_l^j \psi_l^j(x). \tag{1}$$



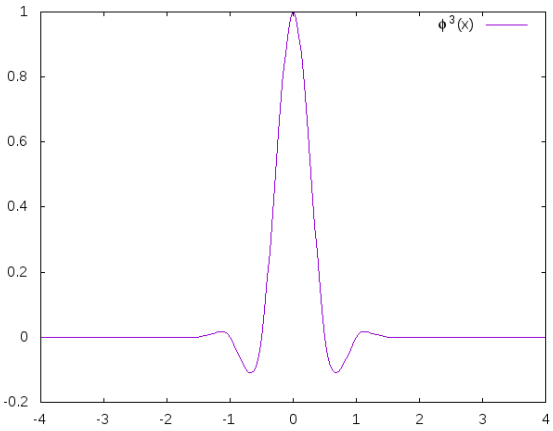
(a) $j = 0$



(b) $j = 1$

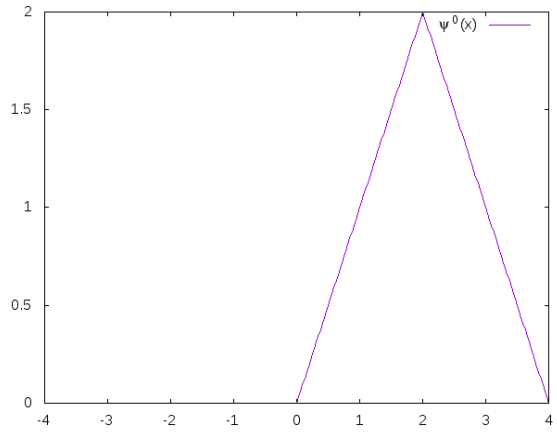


(c) $j = 2$

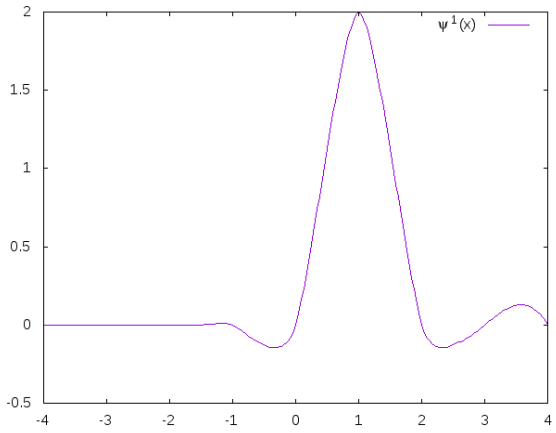


(d) $j = 3$

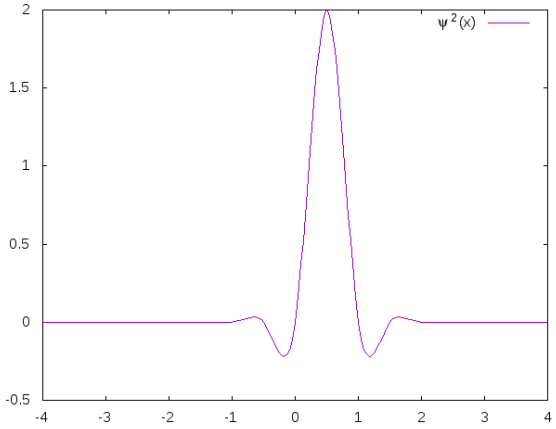
Figure 1: Scaling functions $\phi(x)$ for various levels j.



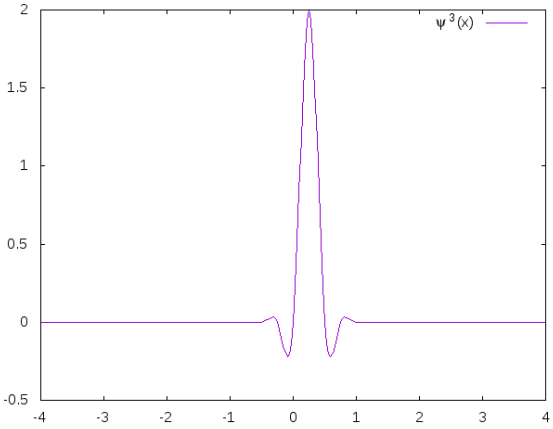
(a) $j = 0$



(b) $j = 1$



(c) $j = 2$



(d) $j = 3$

Figure 2: Daughter wavelet functions $\psi(x)$ for various levels j.

2. Once a function can be approximated, an algorithm to throw away small detail coefficients can be developed.

3. The grid points can then be altered using the binary tree structure.

4. Develop a code to calculate spatial derivatives as in Vasilyev & Bowman (2000).