Ma 541: Topics in Applied Mathematics: Wavelet Algorithms Homework Assignment 3

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Due Friday, November 20th, 2008

- 1. Implement routines (in R or Macsyma) for Laurent polynomial multiplication, addition, determination of degree, and substitution $z \leftarrow z^{-1}$.
- 2. Implement routines (in R or Macsyma) for multiplication, addition, transposition, and substitution $z \leftarrow z^{-1}$ for 2×2 matrices of Laurent polynomials.
- 3. Implement routines (in R or Macsyma) to extract p_e and p_o , the even and odd parts, of a Laurent polynomial p. Similarly, implement routines to recombine p_e and p_o to recover p.
- 4. Implement routines (in R or Macsyma) for Laurent polynomial division. Have your function return a list of all possible pairs of quotient and remainder for each pair of inputs.
- 5. Implement routines (in R or Macsyma) to find a greatest common divisor for two Laurent polynomials. Have your function return a list of the intermediate quotients and remainders.
- 6. Find nearest-neighbor lifting factorizations for the Daubechies filters of lengths 2, 4, 8, and 16.
- 7. Use the nearest-neighbor lifting method to implement the periodic filter transform on an arbitrary signal with an even period 2N. Use the Daubechies filters of lengths 2, 4, 8, and 16.

Similarly, implement the adjoint periodic filter transform.

Test whether your transform preserves norms and gives perfect reconstruction.