Computing n-Variate Orthogonal Wavelet Transforms on Graphics Processing Units II: Bijective Mapping Between the Local and Global Indices

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In the previous part of this study (L.T. Dechebsky, J. Gundersen, B. Bang, Computing n-Variate Orthogonal Wavelet Transforms on Graphics Processing Units, In: I. Lirkov, S. Margenov, and J. Wasniewski (Eds.) LSSC'2009, LNCS 5910, Springer-Verlag, Berlin-Heidelberg, 2010, to appear) we outlined a new algorithm for matching an n-variate orthonormal wavelet basis $b_{n,j(n)}$ obtained via multiresolution analysis up to a given resolution level $j(n)$, $n = 3, 4, \ldots$, bijectively onto 1- and 2-variate bases $b_{k,j(k)}$, $k = 1, 2$, of the same type but with lower number of variables $k < n$ and with higher resolution level $j(k) > j(n)$, so that the dimensions of the bases are the same. We termed this approach *isometric conversion between dimension and resolution*, and described the resulting algorithm up to *a bijection between respective blocks of basis functions*. This is enough to show that the algorithm provides a matching of the bases and that this matching is unique. However, for the actual computational purposes it is necessary to move one step further by elaborating the construction down to matching the individual basis functions in the blocks. This is the purpose of the present paper, whose main new result is a bijective mapping between the local indices in each of the afore-mentioned blocks and a global set of indices which defines the number of the basis function in the basis. With the help of this bijection we define a 1-1 mapping between the indices of $b_{n,j(n)}$ and $b_{k,j(k)}$ for any two natural n and k. When $k = 2$ we use this for computing of the n-variate discrete wavelet transform (DWT) on the graphics processing unit(s) (GPU(s)) of the computer, used as a parallel processing architecture.