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Semibranching function systems, representations, wavelets, and spectral triples for k-graphs

In joint work with Gillaspy, Kang, and Packer, we generalized the definition of semibranching function systems from directed graphs to finite higher-rank graphs (k-graphs). This enabled us to construct a wavelet-type orthogonal decomposition on the infinite path space of the k-graph. In subsequent joint work with Gillaspy, Julien, Kang, and Packer, we show that this wavelet decomposition is closely tied to the Cantor set spectral triples introduced by Pearson and Bellissard. In particular, we show that the Farsi-Gillaspy-Kang-Packer wavelet decomposition agrees with the decomposition as eigenspaces of the Laplace-Beltrami operators of the Pearson-Bellissard spectral triples. To do this, we recast the Cantor set spectral triples in the k-graph set-up by using the infinite path space of the k-graph as our Cantor set. Moreover, in joint work in progress with Gillaspy, Jorgensen, Kang, and Packer, we also study monic, atomic, and permutative representations for finite k-graphs associated to k-graph semibranching function systems, thus generalizing results on representations of Cuntz algebras to the k-graphs set-up.