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Alexander Teplyaev* (teplyaev@math.uconn.edu), Department of Mathematics, University of Connecticut, Storrs, CT 06269-3009. *Harmonic coordinates on fractals with finitely ramified cell structure.*

We define sets with finitely ramified cell structure, which are generalizations of p.c.f. self-similar sets introduced by Kigami and of fractafolds introduced by Strichartz. In general, we do not assume even local self-similarity, and allow countably many cells connected at each junction point. In particular, we consider post-critically infinite fractals. We prove that if Kigami's resistance form satisfies certain assumptions, then there exists a weak Riemannian metric such that the energy can be expressed as the integral of the norm squared of a weak gradient with respect to an energy measure. This generalizes earlier results of Kusuoka and the author. Furthermore, we prove that if such a set can be homeomorphically represented in harmonic coordinates, then for smooth functions the weak gradient can be replaced by the usual gradient, which generalizes an earlier result of Kigami. We also prove a simple formula for the energy measure Laplacian in harmonic coordinates. (Received March 04, 2006)