

# Renormalization of a one-parameter family of piecewise isometries

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## Abstract

We consider a one-parameter family of piecewise isometries of a rhombus. Rotation angles are all multiples  $\pi/4$ , and coordinates lie in the quadratic number field  $K = \mathbb{Q}(\sqrt{2})$ . We show that the renormalization dynamics is characterized by a parameter transformation  $r$  which is the second iterate of a map  $f$  of the generalised Lüroth type (a piecewise-affine version of Gauss' map), whose eventually periodic points coincide with the elements of  $K$  in the parametric interval. We prove that exact scaling occurs if and only if the parameter belongs to  $K$ . Our proofs rely on computer-assisted return-map analysis involving the participation of piecewise isometries of tiled domains whose tiling structures vary continuously with the parameter.