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The Quadratic Irrationals and Ducci Matrix Sequences.

The Ducci map is defined by taking a vector $[v_1, \dots, v_n]^T \in \mathbb{R}^n$ to $[|v_1 - v_2|, \dots, |v_n - v_1|]^T$. We concern ourselves with the Ducci map's action in \mathbb{R}^3 , establishing a connection between the sequences of matrices associated with the action of the Ducci map, continued fraction representations of the real numbers, and the Stern-Brocot tree. It is shown that the real numbers have a representation via sequences of Ducci matrices, and in this Ducci number system there are essentially three types of matrix sequences: one type corresponding to the rationals, one to the quadratic irrationals, and then those types that correspond to all other real numbers. This mirrors the situation for continued fraction representations of the reals. It follows that the Ducci map on \mathbb{R}^3 is closely connected to the Euclidean algorithm and, through its action, locates best rational approximations to the irrationals. (Received September 11, 2015)