1096-05-625   **Tri Lai*** (`tmlai@indiana.edu`), 2001 E Lingelbach Ln, Apt 238, Bloomington, IN 47408. *New aspects of lattice regions whose tilings are enumerated by perfect powers.*

In 2003, Ciucu presented a unified way to enumerate tilings of lattice regions by using a certain Reduction Theorem (Ciucu, Perfect Matchings and Perfect Powers, Journal of Algebraic Combinatorics, 2003). We continue this line of work by investigating new families of lattice regions whose tilings are enumerated by perfect powers or products of several perfect powers. We prove a multi-parameter generalization of Bo-Yin Yang's theorem on fortresses (B.-Y. Yang, Ph.D. thesis, Department of Mathematics, MIT, MA, 1991). On the square lattice $\mathbb{Z}^2$ with zigzag paths drawn in, we consider two particular families of regions whose numbers of tilings are always a power of 3 or twice a power of 3. The latter result provides a new proof for a conjecture of Matt Blum first proved by Ciucu. We also obtain a large number of new lattices by periodically applying two simple subgraph replacement rules to the square lattice $\mathbb{Z}^2$. On some of those lattices, we get new families of regions whose numbers of tilings are given by products of several perfect powers. In addition, we prove a simple product formula for the number of tilings of a certain family of regions on a variant of the triangular lattice. (Received September 08, 2013)