

We consider the inverse problem of recovering a two-dimensional perfectly reflecting diffraction grating from scattered waves measured above the structure. We establish the uniqueness within the class of general polygonal grating profiles by a minimal number of incoming plane waves, without excluding Rayleigh frequencies and further geometric constraints on the profile. This extends and improves the uniqueness results of Elschner, Schmidt and Yamamoto [Inverse Problems 19 (2003), 779–787].