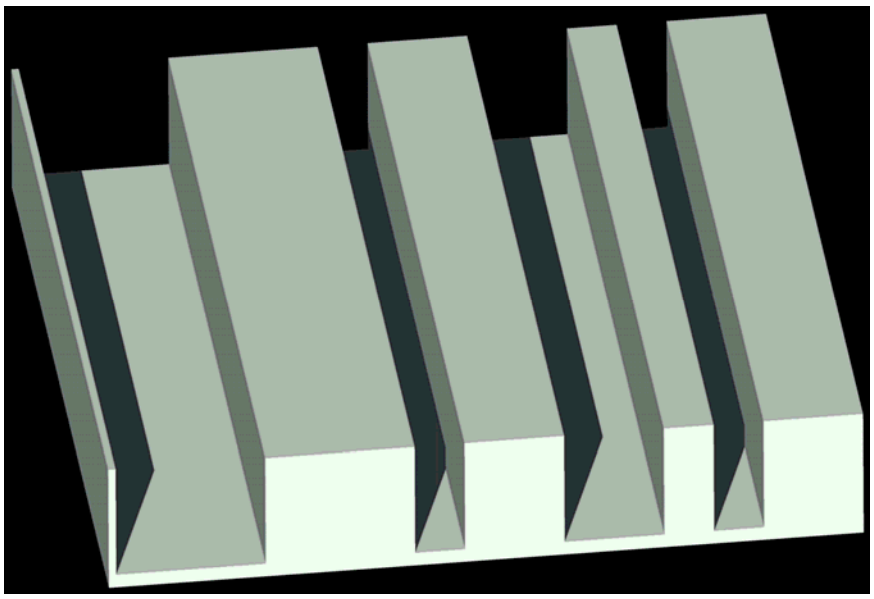
In 1975, Manfred R. Schroeder, an acoustician, proposed the use of an acoustic diffraction grating (*aka* phase-grating) as an effective sound diffuser, *e.g*. for use in small listening rooms. The theory of ***phase-grating*** sound diffusers is based on ***number theory***, Schroeder used a mathematical scheme known as ***maximum length sequences***, which are a stream of fixed-length digital 1's and 0's with some interesting statistical properties. He built a prototype sound diffuser using a piece of sheet metal bent into the necessary geometrical pattern of digital 1's and 0's to confirm his theory of acoustical scattering from such an object; it looked similar to that shown in the figure below.



A 1-Dimensional Maximum Length Sequence (MLS) Phase-Grating Sound Diffuser

Note that such a MLS/PGD sound diffuser scatters the sound only in one direction – *e.g*. if the grooves are vertical, the scattering of sound is in the horizontal direction, *e.g*. similar to what a diffraction grating does in scattering visible light.

Since Schroeder's initial work much additional theoretical and experimental work has gone into the development of many new types of sound diffusers – so-called ***quadratic-residue*** diffusers (QRD's) and ***primitive-root*** diffusers (PRD's), building on Schroeder's initial theory of ***phase-grating*** sound diffusers.

The figure below shows a cross sectional view of a 1-D ***quadratic residue*** type phase-grating sound diffuser, consisting of a structure that has a repeating sequence of wells that scatter sound within a certain frequency band.