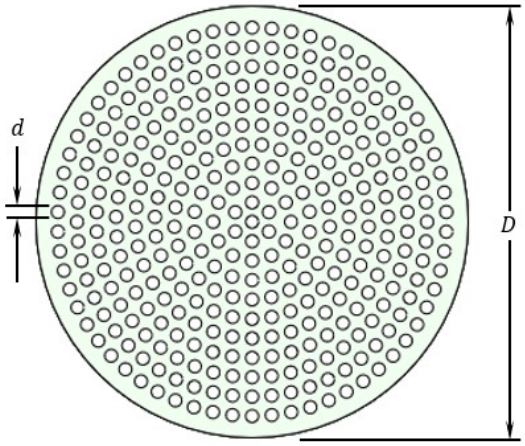
Grille Generator

Introduction

This document outlines an algorithm for generating a circular grille pattern with a uniform hole density. Many CAD programs provide for circular patterns, but a circular grille generally does not have an obvious plane of symmetry for easy specification.



Method

The pattern generated by this algorithm is generally fixed. That is, the pattern is scaled and truncated to fit a desired aspect ratio of hole diameter d to overall diameter D. The distance between rings is $1.5\ d$ and the arc segment between holes on the same ring is approximately $1.5\ d$ because partial holes are not allowed. The pattern is repeated until the next ring would exceed D. The infinite unit pattern is thus independent of d and D.

The algorithm also allows for specification of the initial hole angle ϕ_i and the subsequent phase shift per ring ϕ_{shift}. The main purpose of these are to tweak the pattern to obscure obvious linear radial patterns if desired. The plot on the next page helps illustrate this.

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Algorithm

$$generate\_grille\left(d, D, \phi_i, \phi_{shift}\right) := \left\| \begin{array}{l} pattern \leftarrow [0 \;\; 0] \\ n \leftarrow 1 \\ \phi_n \leftarrow \phi_i \\ rings \leftarrow \text{floor}\left(\frac{D-d}{3\ d}\right) \\ \text{for } i \in 1,2..rings \\ \quad \left\| \begin{array}{l} R_i \leftarrow 1.5 \cdot i \cdot d \\ N_i \leftarrow \text{floor}\left(2\ \pi \cdot i\right) \\ \alpha_i \leftarrow \frac{360\ deg}{N_i} \\ \text{for } j \in 1,2..N_i \\ \quad \left\| \begin{array}{l} pattern_{n,0} \leftarrow \text{pol2xy}\left(R_i, \phi_n\right)_0 \\ pattern_{n,1} \leftarrow \text{pol2xy}\left(R_i, \phi_n\right)_1 \\ \phi_n \leftarrow \phi_n + \alpha_i \\ n \leftarrow n+1 \end{array} \right. \\ \phi_n \leftarrow \phi_n + \phi_{shift} \end{array} \right. \\ \text{return } pattern \end{array} \right.$$

$$example := generate\_grille\left(3, 100, -90\ deg, 0\ deg\right)$$

Inputs

$$\mathbf{X} := example^{\langle 0 \rangle} \qquad \mathbf{Y} := example^{\langle 1 \rangle}$$