Freedom of FREEFORMS

Fewer elements | Lighter weight | Increased flexibility

OPTIMAX®
What is a Freeform?

An optical surface with little to no symmetry.

Why design with freeforms?

Designing with freeforms will make your project have:

- Fewer elements
- Lighter weight
- Increased flexibility

And in the end overall better performance.

Tolerancing Limits for Freeform Surfaces

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter (mm)</td>
<td>20</td>
<td>500</td>
</tr>
<tr>
<td>Characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild (interferometrically testable)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wild (deviation less than size of part)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extreme (deviation on order of size of part)</td>
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<td></td>
</tr>
</tbody>
</table>

Learn more | www.optimaxsi.com/freeforms
# Common Freeforms

## Toroid

\[
Z = \frac{C_x X^2 + C_y Y^2}{1 + \sqrt{1 - C_x^2 X^2 - C_y^2 Y^2}} \quad C_x = \frac{1}{R_x} \quad C_y = \frac{1}{R_y}
\]

## Atoroid/Biconic

\[
Z = \frac{C_x X^2 + C_y Y^2}{1 + \sqrt{1 - (1+k_x)C_x^2 X^2 - (1+k_y)C_y^2 Y^2}} \quad C_x = \frac{1}{R_x} \quad C_y = \frac{1}{R_y}
\]

## Acylinder

\[
Z = \frac{C_x X^2}{1 + \sqrt{1 - (1+k)(C_x^2 X^2)}} + a_1 X^2 + a_2 X^4 + a_3 X^6 + a_4 X^8 + a_5 X^{10} \quad C_x = \frac{1}{R_x}
\]

## Off-Axis Parabola (OAP)

\[
Z = \frac{C_x X^2}{1 + \sqrt{1 - (1+k)(C_x^2 X^2)}} + a_1 X^2 + a_2 X^4 + a_3 X^6 + a_4 X^8 + a_5 X^{10} \quad C_x = \frac{1}{R_x} \quad \text{Where } k = -1
\]

## Anamorph

\[
Z = \frac{C_x X^2 + C_y Y^2}{1 + \sqrt{1 - (1-K_x)(C_x^2 X^2) - (1+K_y)(C_y^2 Y^2)}} + AR[(1-AP)X^2 + (1+AP)Y^2]^2 + BR[(1-BP)X^2 + (1+BP)Y^2]^3 + CR[(1-CP)X^2 + (1+CP)Y^2]^4 + DR[(1-CP)X^2 + (1+DP)Y^2]^5 \quad C_x = \frac{1}{R_x} \quad C_y = \frac{1}{R_y}
\]

## XYZ Freeforms or Solid Model

Freeform: Surface created from point cloud or solid model.

## Other Equation Based Freeforms

Zernike Polynomials, XY Polynomials, etc.
Optimax Abbe Diagram*

Optimax can make low surface roughness optics from all of these materials.

* For reference use only
Transmission Bands of UV, Visible and IR Materials*

- Glass
- Calcium Fluoride
- Sapphire
- Barium Fluoride
- Spinel
- AION
- Diamond
- Magnesium Oxide
- Yttria
- Multispectral Zinc Sulfide
- Zirconia
- Polycrystalline Alumina
- Zinc Selenide
- Magnesium Fluoride (hot pressed)
- Chalcogenide
- Silicon
- Germanium

* For reference use only