7.1 Gaussian beam

Developing Matlab

In the program, ABCD law for passing Gaussian beam trough an optical system, is exploited. Entering wavelength, radius of the beam W_1, and radius of the equiphase surface R_1, complex curvature at the beginning of the system q_1 is evaluated, which consists of a real component a_1 and of an imaginary one b_1:

```
a1 = k^2 * R1 * W1^4 / (k^2 * W1^4 + 4*R1^2);
b1 = -2*k * R1^2 * W1^2 / (k^2 * W1^2 + 4*R1^2);
```

This complex parameter is used for evaluating beam curvature behind the optical element

```
q2 = (A*q1 + B) / (C*q1 + D);
```

Here, A, B, C, D are elements of the matrix of the optical element.

In order to determine the beam radius W_2 and the equiphase surface radius R_2 behind the optical element, following relations are used:

```
W2 = sqrt( (2*(A*a1+B)^2 + (A*b1)^2) / (k*b1*((A*a1+B)*C - A*(C*a1+D))));
R2 = ((A*a1+B)^2+(A*b1)^2)/((A*a1+B)*(C*a1+D)-A*(C*a1+D));
```

Next, variation of parameters W and R in a given distance behind the optical elements is computed using the following relations:

```
W2z(zz) = sqrt((W2)^2*(1+zn/R2)^2+(2*zn/(k*W2))^2); R2z(zz) = ((R2+zn)^2*
(k*W2^2)^2+4*zn^2*R2^2)/((R2+zn)*(k*W2^2)^2+4*zn*R2^2);
```

Evaluated parameters W and R are shown for single equiphase surfaces depending on the distance from the optical element.