A resonator with Bessel – Gauss transverse mode distribution.

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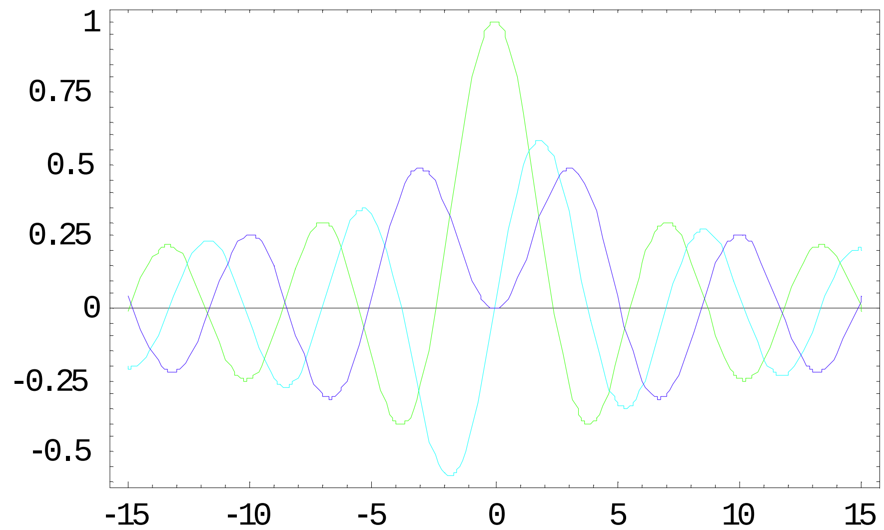
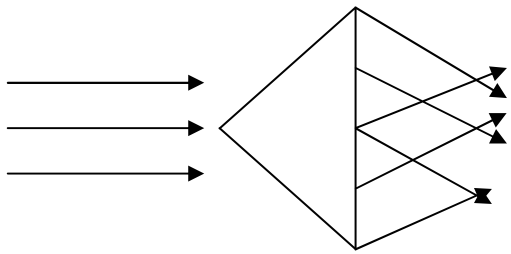
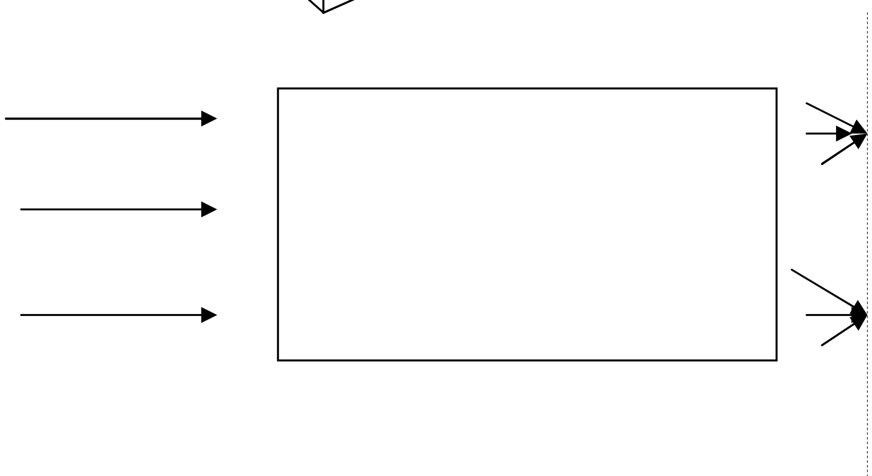
- Bessel function
- Bessel-Gauss resonator (analytical investigation)
- Bessel-Gauss resonator (Fox-Li investigation)

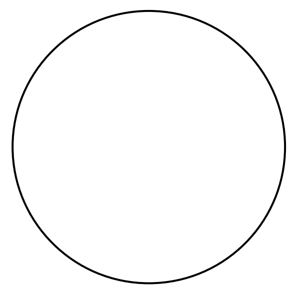
$$\frac{\partial^2 w}{\partial x^2} + \frac{1}{x}\frac{\partial w}{\partial x} + \left(1 - \frac{n^2}{x^2}\right) w = 0$$

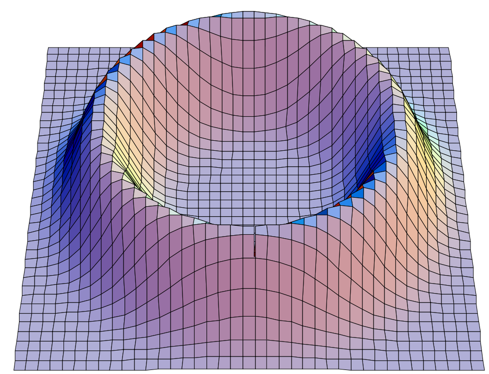
$J_n(x)$











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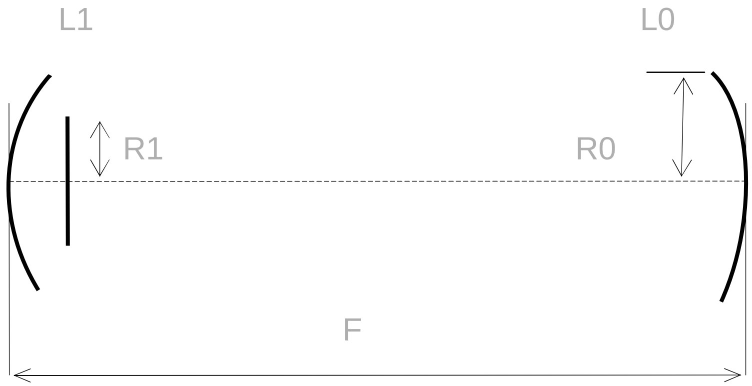
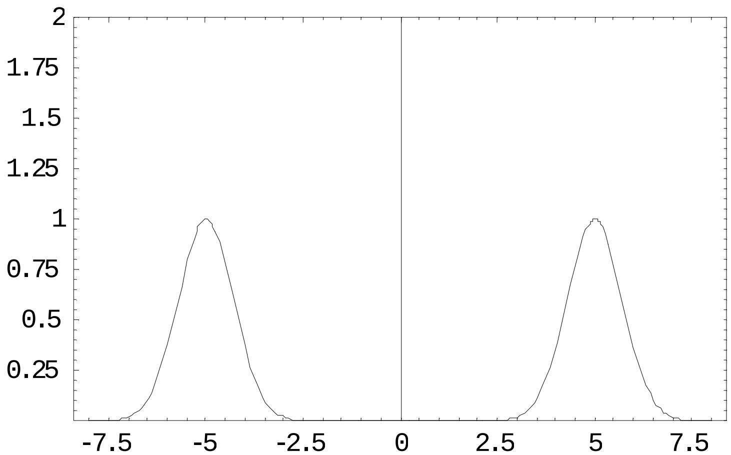


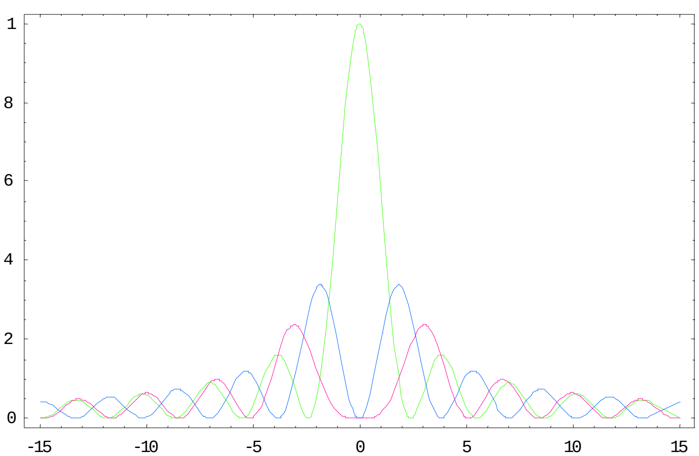
$$F_n(q,\varphi) = \int_0^{R_0} f(r,\varphi) J_n(qr) r dr$$

$$f(r,\varphi) = A J_n(qr) \exp(-r^2/w^2) \exp(in\varphi)$$

$$J_n(qr) \approx \frac{1}{r}\cos(qr + n\frac{\pi}{2})$$

$$F_n(q,\varphi) = \exp(in\varphi) A \int_0^{R0} J_n(qr)^2 \exp(-\frac{r^2}{w^2}) r dr$$





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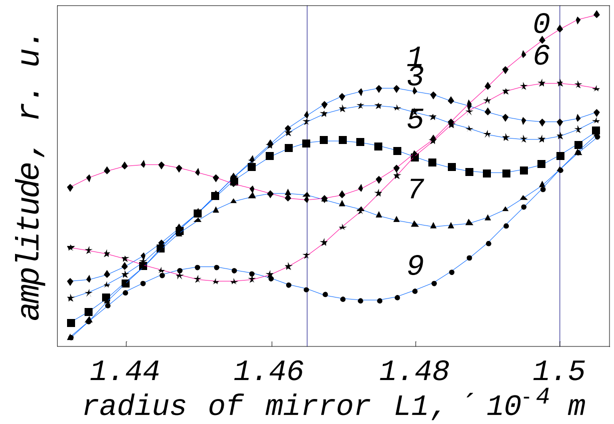
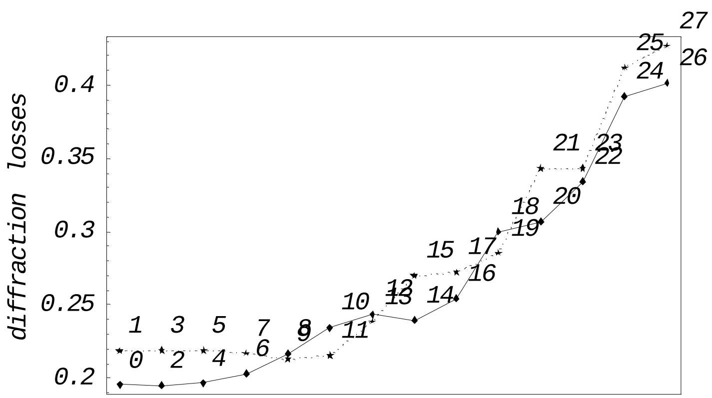
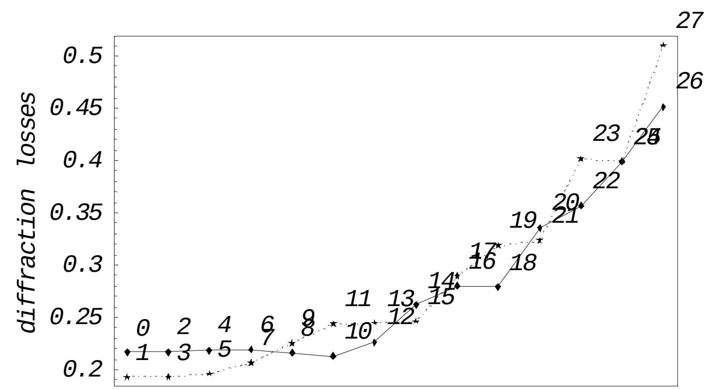


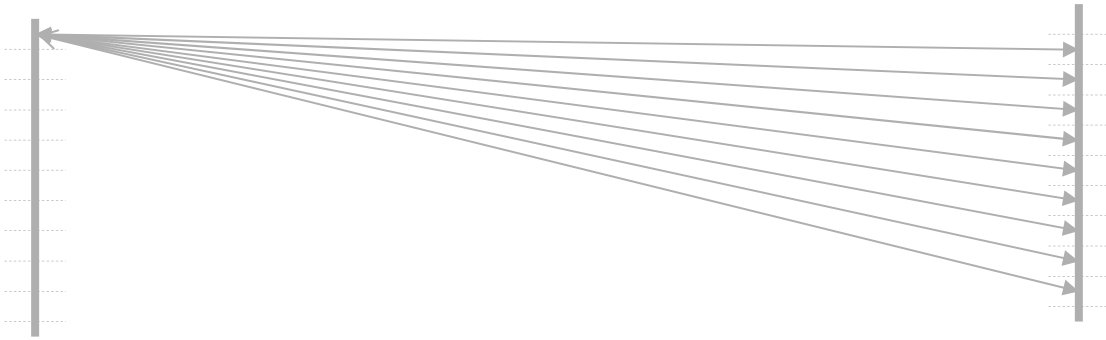
f = 0.7 м, R1=0.95 R0, λ=0.53 10-6м

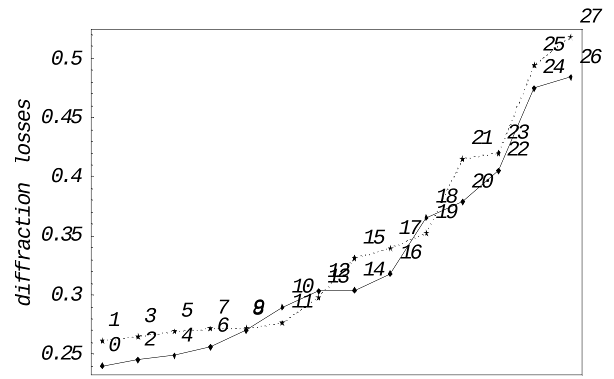


f = 0.7 m, **R0=1.5 10 -4m**, R1=0.9 R0, λ=0.53 10-6m



f = 0.7 м, **R0=1.465 10 -4м**, R1=0.9 R0, λ=0.53 10-6м





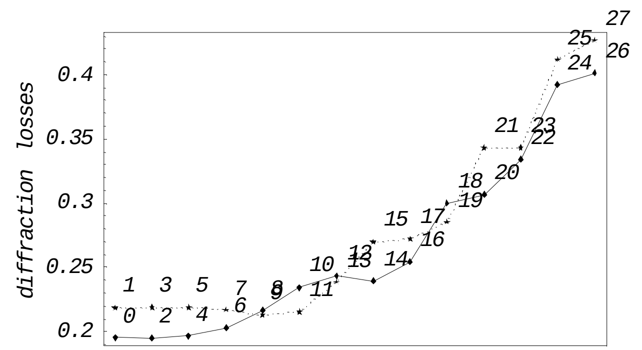
f = 0.7 m, **R0=1.5 10 -4m**, R1=0.9 R0, λ=0.53 10-6m
(Fox-Li Method)

$$A_1(x_1) = a_0 \frac{\exp(ikL)\exp(i\frac{k}{2L}x_1^{\,2})}{i\lambda L}\int_{-R_0}^{R_0} A_0(x)\exp(i\frac{k}{2L}x^2)\exp(i\frac{k}{L}x_1 x)dx =$$

$$= a_0 \frac{\exp(ikL)\exp(i\frac{k}{2L}x_1^{\,2})}{i\lambda L}\sum_{-R_0}^{R_0} A_i \sum_i \int_{-R_i}^{R_i+\Delta r} \exp(i\frac{k}{2L}x^2)\exp(i\frac{k}{L}x_1 x)dx$$

$$\begin{pmatrix} A^1{}_1 \\ A^1{}_2 \\ . \end{pmatrix} = \begin{pmatrix} A^0{}_1 \\ A^0{}_2 \\ . \end{pmatrix} \begin{pmatrix} \int_{R_{0i}}^{R_i+\Delta r} \exp(i\frac{k}{2L}x^2)\exp(i\frac{k}{L}x_1 x)dx & \int_{-R_i}^{R_i+\Delta r} \exp(i\frac{k}{2L}x^2)\exp(i\frac{k}{L}x_2 x)dx & \dots \\ \int_{R_i}^{R_i+2\Delta r} \exp(i\frac{k}{2L}x^2)\exp(i\frac{k}{L}x_1 x)dx & \int_{-R_i}^{R_i+2\Delta r} \exp(i\frac{k}{2L}x^2)\exp(i\frac{k}{L}x_2 x)dx & \dots \\ \dots & \dots & \dots \end{pmatrix}$$

$$A_{i+1} = A_i B$$



f = 0.7 m, **R0=1.5 10 -4m**, R1=0.9 R0, λ=0.53 10-6m
Analytic calculation

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Thank you!

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