

# FD010 - Principles of modern optics imaging methods

## Technical documentation for the script "Lens parameter calculation"

Typed by Petr Šafařík

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# 1 Getting Started

Before using the script, please make sure your system meets the following requirements:

## 1.1 Minimum Requirements

- ZX Spectrum
- Tape recorder (ZX Spectrum included)
- Tape
- Television (for ZX Spectrum video-output)
- OpenOffice

## 1.2 Recommended Requirements

- PC
- with RAM
- and Hard disk
- internet, USB, floppy or CD-rom included
- Linux
- OpenOffice

## 1.3 Not Recommended Requirements

- Microsoft Windows 95
- Microsoft Windows 98
- Microsoft Windows ME
- Microsoft Windows 2000
- Microsoft Windows XP
- Microsoft Windows Vista
- Microsoft Office (any)

## 1.4 Multiplayer

It's script, not game. Please make sure, you're reading correct file!

## 1.5 Supported Peripherals

However it's not game, these peripherals are supported:

- Microsoft Sidewinder Force Feedback Wheel
- Logitech Wingman Pro Wheel

## 1.6 Windows 95 users

Please, go to National Technical Museum in Prague, they will thank's you for this machines... And by the way, any Windows have not technical support.

## 1.7 Windows NT 4.0

I do not support Windows NT.

## 1.8 Windows 2000

Although Windows 2000 is not officially supported, script should still run. For best performance please ensure you have installed the latest service pack, which can be found at Microsoft's Home Page.

# 2 Installation

Place the script CD into your CD/DVD-ROM drive (tape recorder). If your computer is AutoPlay enabled, script's program will not automatically appear. Open CD-ROM drive (play tape) and wait to load the file.

# 3 Default Keyboard Settings

For Windows users:

`alt + ctrl + del` (many times).

## 4 Peripherals

In order for your steering wheel or joystick to be correctly recognised, you must create a profile for it within Windows prior to launching the game. To this, please consult the documentation and software packaged with your peripheral.

Before launching please ensure that all controller pedals have been set-up as separate axis from within the Windows Control Panel. From within script, also ensure that all axis of the controller (i.e. the wheel and pedals) have been correctly configured and calibrated. I.e. Steer left = Turn wheel to the left. Steer Right = Turn wheel to the right Etc.

## 5 Customer Service Information

### TECHNICAL SUPPORT

Thank you for using this product. If you are experiencing difficulties with this title, please take advantage of the following product support. Please note that all our operators only speak English and Czech only.

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Technical Support:	775 045 446
Fax:	none
Internet email:	petos@mail.muni.cz
World Wide Web:	<a href="http://monoceros.muni.cz/~petos">http://monoceros.muni.cz/~petos</a>

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### Address:

Customer Services Department  
 Petr Šafařík  
 Koleje Tvrdého 5/7  
 Brno  
 612 00

In the unlikely event of a software fault please return the complete package, with your receipt, to the original place of purchase.

If you do telephone, please be sitting in front of your computer (if possible) and be sure to provide us with as much information as possible. Make sure to note the exact type of hardware that you are using in your system, including:

- Speed and Manufacturer of your Processor.
- Make & Model of your Sound Card and Video Card.

- Make & Model of your CD-ROM drive.
- Amount of RAM present.
- Any additional Hardware and Peripherals.
- Prepare a hammer (if you're not using Linux, you will be ask to use it)

**Note:** If you have any problems in obtaining any System Information please consult your System supplier. It is extremely important that you have the information above at hand when you call.

When contacting us by post, ensure you include the Title & Version, a detailed description of the problem you are experiencing and the exact type of hardware that you are using.

Please, don't fax us anything. Anywhere.

## 6 How to use it

### 6.1 Shortly

Load enter parameters of the lens and enviroment. And at blue-white cells you will be able to read the result.

### 6.2 Not so shortly

1. As the first thing you have to enter parameters of the enviroment and the lens. There are:
  - (a) Of the enviroment, refractive index of the left enviroment, of the lens a and of the right enviroment (from the lens)
    - Left refractive index  $n_0$
    - Refractive index of lens  $n_1$
    - Right refractive index  $n_2$
  - (b) Lens parameters. There are coordinates of the vertexes and centres of curvature.
    - Left lens vertex  $v_1$
    - Right lens vertex  $v_2$
    - Centre of curvature 1  $s_1$
    - Centre of curvature 2  $s_2$

Make sure you have put correct numbers to *all* red columns!

2. In the second step the relative refractive indexes will be set.

$$N_{01} = \frac{n_0}{n_1}$$

$$N_{12} = \frac{n_1}{n_2}$$

3. Matrix determination.

$$R_2 = \begin{pmatrix} 1 & 0 \\ \frac{1-N_{12}}{v_2-s_2} & N_{12} \end{pmatrix}$$

$$T_{12} = \begin{pmatrix} 1 & v_2 - v_1 \\ 0 & 1 \end{pmatrix}$$

$$R_1 = \begin{pmatrix} 1 & 0 \\ \frac{1-N_{01}}{v_1-s_1} & N_{01} \end{pmatrix}$$

4. The matrix  $S$  of the system is set in this step.

$$S = R_2 T_{12} R_1$$

$$S = \begin{pmatrix} 1 & 0 \\ \frac{1-N_{12}}{v_2-s_2} & N_{12} \end{pmatrix} \cdot \begin{pmatrix} 1 & v_2 - v_1 \\ 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} 1 & 0 \\ \frac{1-N_{01}}{v_1-s_1} & N_{01} \end{pmatrix}$$

$$S = \begin{pmatrix} s_{11} & s_{12} \\ s_{21} & s_{22} \end{pmatrix}$$

5. Results

- Image focal point  $F_I$

$$F_I = v_2 - \frac{s_{11}}{s_{21}}$$

- Objective focal point  $F_O$

$$F_O = v_1 + \frac{s_{22}}{s_{21}}$$

- Image plane  $H_I$

$$H_I = v_2 + \frac{1 - s_{11}}{s_{21}}$$

- Objective plane  $H_O$

$$H_O = v_1 + s_{12} + \frac{s_{22}(1 - s_{11})}{s_{21}}$$

The result is readable in the blue-white cells.

## 7 Product licence

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