CHAPTER 11-15: Design Forms

Ex1. Design a Cooke Triplet to perform the following specifications:

F/#	: 4
EFL	: 60 mm
FOV	: 10^o
Wavelength	: F, d, C (visible).
Glasses	: SHOTT
Glass thicknesses	: 3-7 mm

After optimization, try to improve optical performance of the design via to Tessar and Heliar forms.

Ex2. Design a Cooke Triplet to perform the following specifications:

F/#	: 3.8
EFL	: 70 mm
FOV	: 15^o
Wavelength	: SWIR (0.9 µm - 1.7 µm).
Glasses	: SCHOTT, CDGM
Glass thicknesses	: 3-7 mm

After optimization, try to improve optical performance of the design via to Tessar and Heliar forms.

Ex3. Design a Double Gauss Lens to perform the following specifications:

F/#	: 3.3
EFL	: 50 mm
EPD	: 15 mm
FOV	: 40^o (Namely SFOV = 0,10,20 deg)
Wavelength	: F, d, C (visible)
Glass Catalog	: SCHOTT
Glass thicknesses	: 3-7 mm

Ex4. Design a Double Gauss Lens to perform the following specifications:

F/#	: 3.3
EFL	: 50 mm
EPD	: 15 mm
FOV	: 40^o (Namely SFOV = 0,10,20 deg)
Wavelength	: F, d, C (visible)
Glass Catalog	: CDGM
Glass thicknesses	: 3-7 mm

Ex5. Design a Double Gauss Lens to perform the following specifications:

F/#	: 3.3
EFL	: 50 mm
EPD	: 15 mm
FOV	: 40^o (Namely SFOV = 0,10,20 deg)
Wavelength	: SWIR
Glass Catalog	: CDGM
Glass thicknesses	: 3-7 mm
Detector pixel size	: 30 µm

Ex6. Design the following LWIR objective using 1, 2 and 3 lenses. (You will have three different designs)

Spectral range	8-14 µm
Focal length	90 mm
f/#	2.5
SFOV	4^o
Materials	Ge–ZnSe–Ge
Glass thicknesses	5-10 mm
Detector Pixel size	25 µm
Total Track Length	< 200 mm
Total Mass	< 200 g

For each of the design, perform optimization to obtain minimum spot radius averaged over FOV.
Compare the performance of designs.

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Ex7. Design the following MWIR objective using 1, 2 and 3 lenses. (You will have three different designs)

Spectral range	3-11 µm
Focal length	90 mm
f/#	2.5
SFOV	4^o
Materials	Si–Ge–Si
Glass thicknesses	5-20 mm
Detector Pixel size	25 µm
Total Track Length	< 200 mm
Total Mass	< 200 g

For each of the design, perform optimization to obtain minimum spot radius averaged over FOV.
Compare the performance of designs:

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Ex8. Design the following SWIR objective using 1, 2 and 3 lenses. (You will have three different designs)

Spectral range	0.9-1.7 µm
Focal length	90 mm
f/#	2.5
SFOV	4^o
Materials	SHOTT, CDGM, HOYA
Glass thickness	5-20 mm
Detector Pixel size	20 µm
Total Track Length	< 200 mm
Total Mass	< 200 g

For each of the design, perform optimization to obtain minimum spot radius averaged over FOV.
Compare the performance of designs:

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Ex9. Design a varifocal zoom system whose focal length is ranging from 100 mm to 225 mm using f_1 = 100 mm and f_2= -100 lenses. Use stock optics.

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Ex10. design a zoom (variable) beam expander from M = 2x to M = 6x for ENPD is 8 mm. Use stock optics.

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Ex11*. Design a Refracting Telescope or Binocular with the following specifications:

Magnification	: 4x
FOV	: 6^o
Diopter	: ± 2
Maximum total length	: 130 mm
Maximum mechanical diameter	: 40 mm
Eye Relief	: 20 mm
Wavelength	: F, d, C visible

Hint: First start with paraxial lenses. Then, replace objective lens with an achromatic doublet and eye piece with Ramsden, Kelner or RKE. Finally, using LDE and MCE editors, optimize the system to reach the specifications.