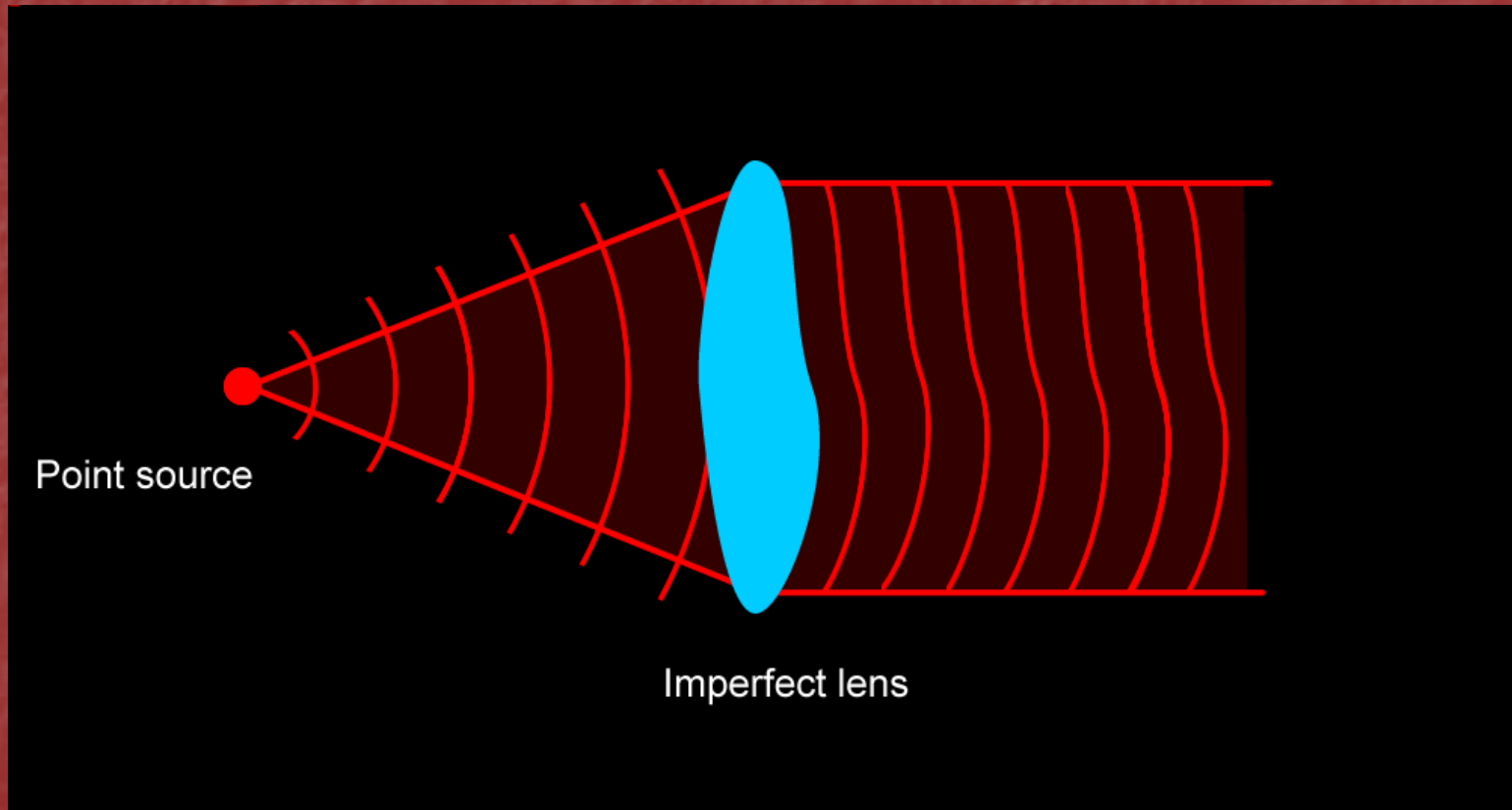
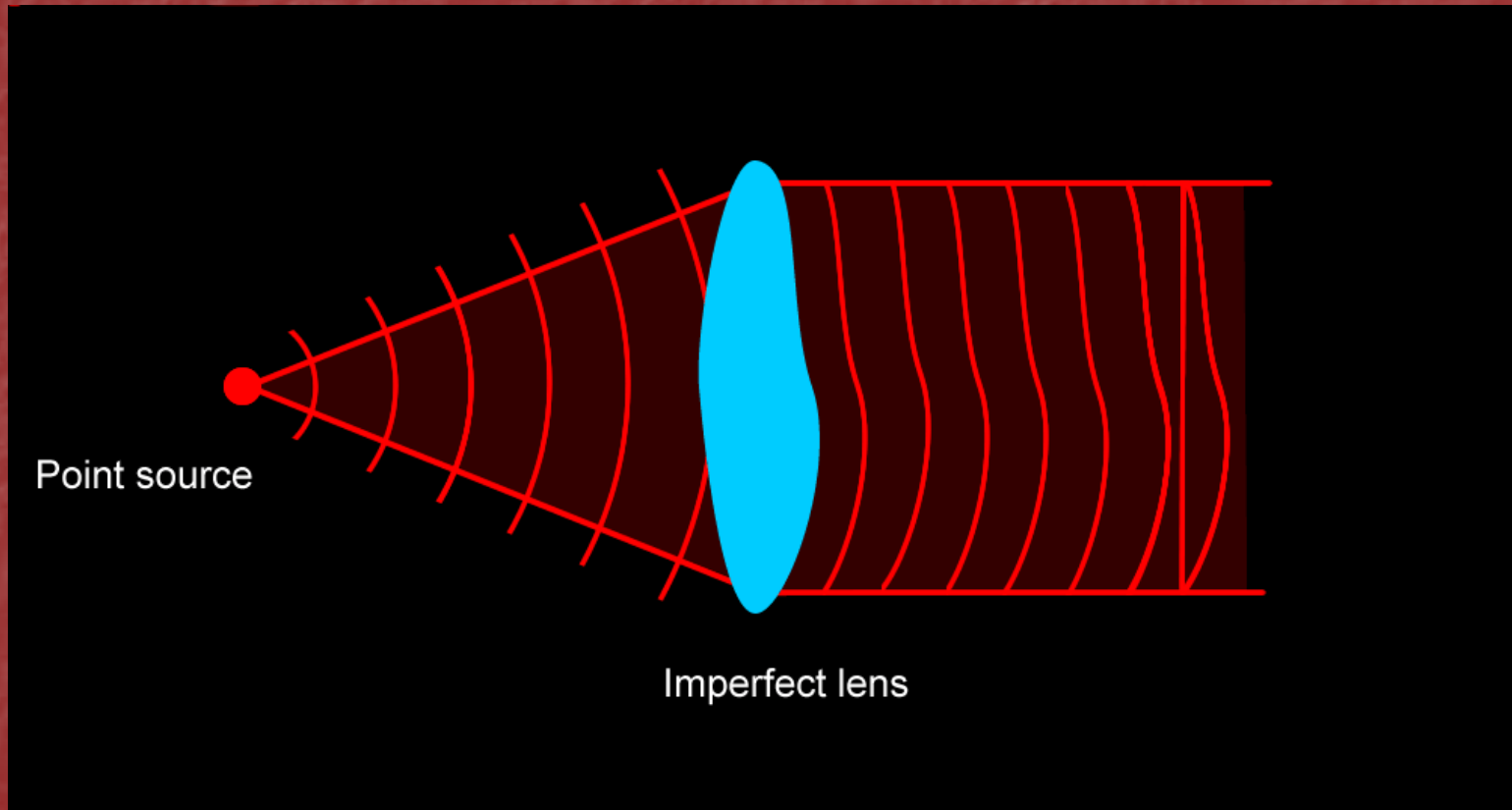


Some basic wavefront theory

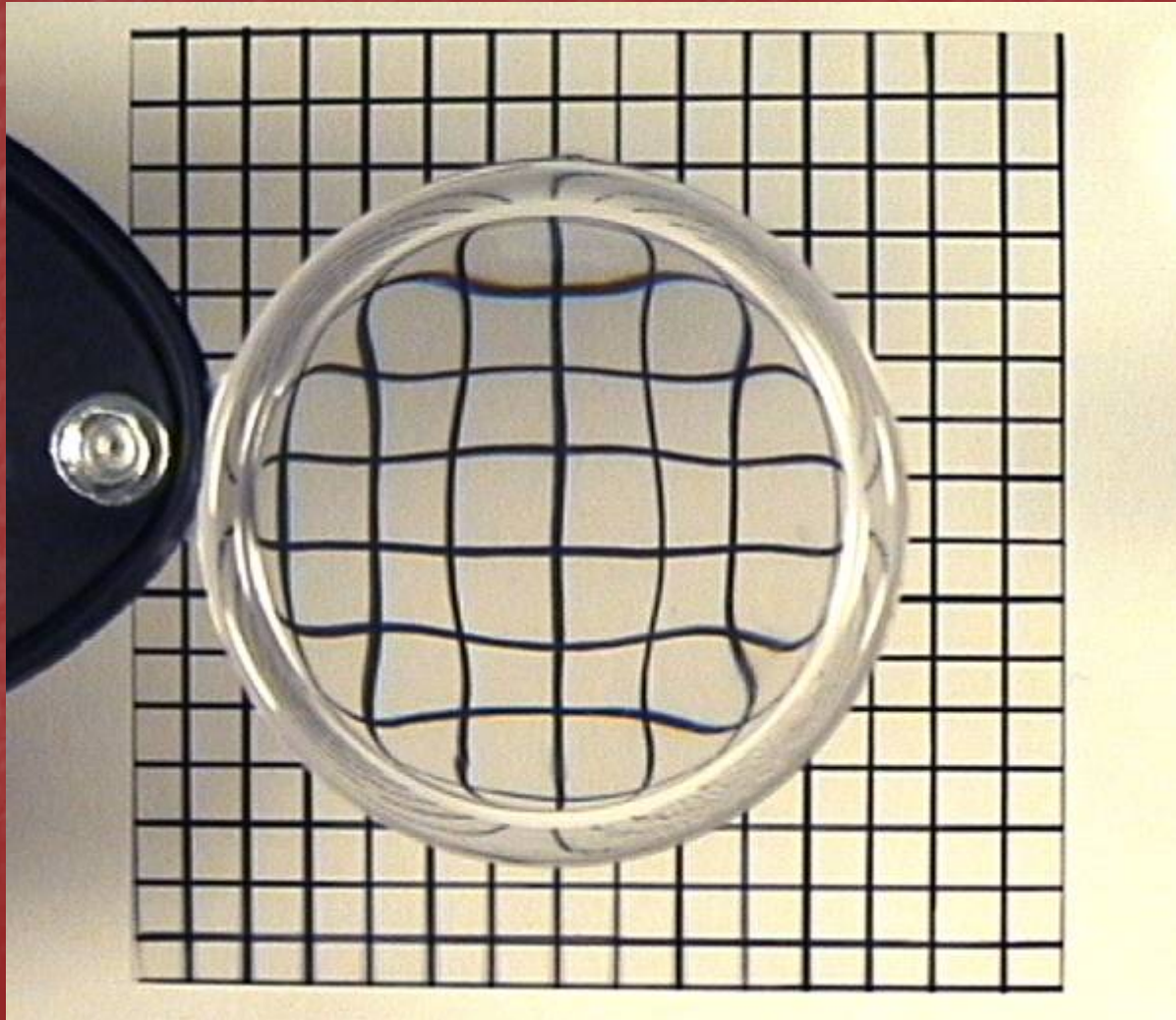
Wavefront aberrations



Wavefront aberrations

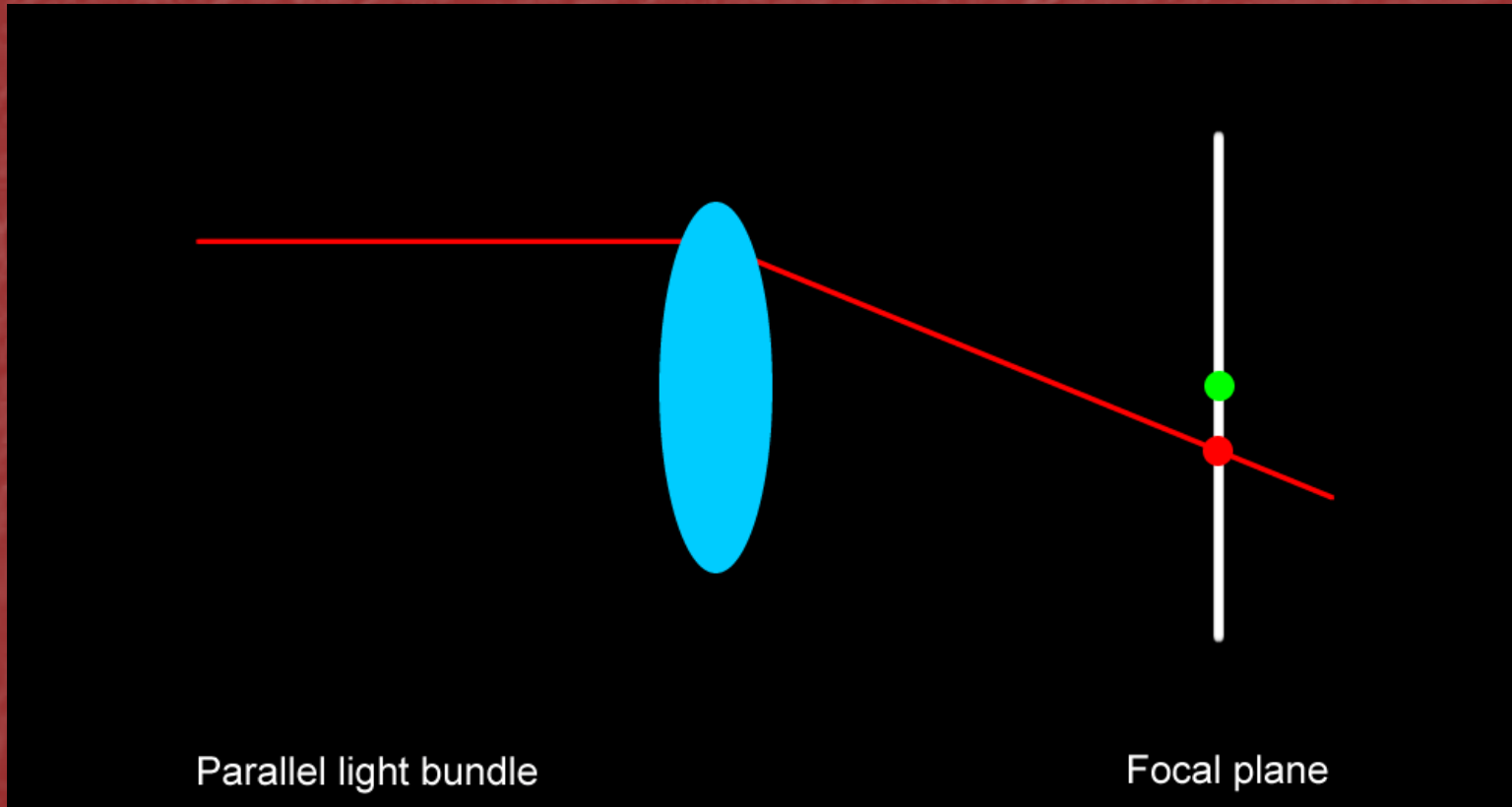


Effect of wavefront aberrations

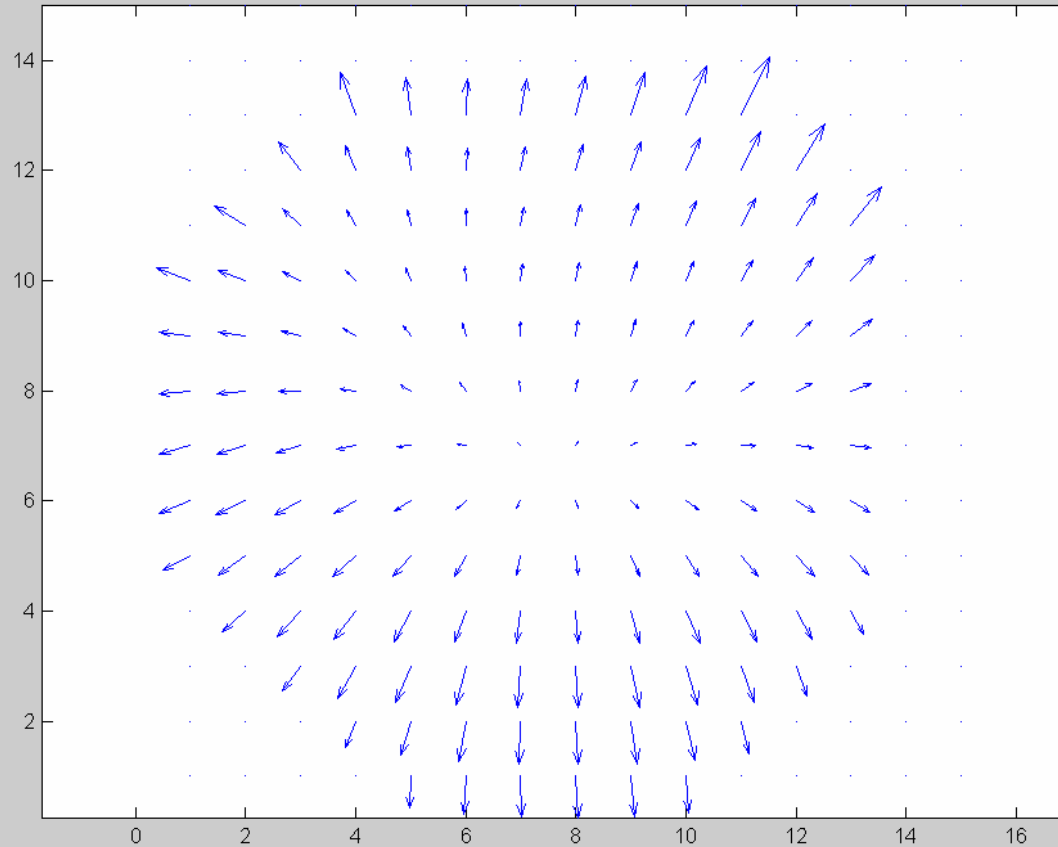


From theory to practice: basic aberrometry





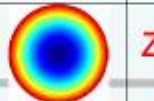
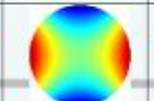
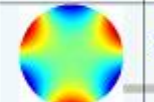
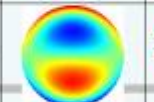


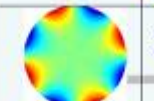

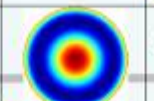

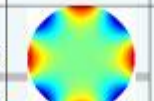
Basic aberrometry: focal shift



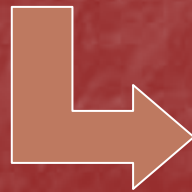
Focus shifts: Gradient map



Basic principles: Zernike polynomials

		Angular frequency m										
		-4	-3	-2	-1	0	1	2	3	4	Radial RMS	
Radial order n	0					 $Z_0^0 = Z_0$ Piston					$RMS = \sqrt{\sum_{n=left}^{right} Z_n^2}$	RMS ₀
	1				 Tilt 0°	 Tilt 90°				RMS ₁		
	2			 Astigmatism 0°	 Defocus	 Astigmatism 45°					RMS ₂	
	3		 Trefoil 0°	 Coma 0°	 Coma 90°	 Trefoil 30°					RMS ₃	
	4	 Tetrafoil 0°	 Astigmatism SO 0°	 Spherical aberration	 Astigmatism SO 45°						RMS ₄	
Zernike Family	Tetrafoils (quadrufoils)	Trefoils	Astigmatisms	Tilt, Comas	Piston, Defocus, spherical aberrations	Tilt, Comas	Astigmatisms	Trefoils	Tetrafoils (quadrufoils)			

What are Zernike polynomials?



Zernike polynomials: an example

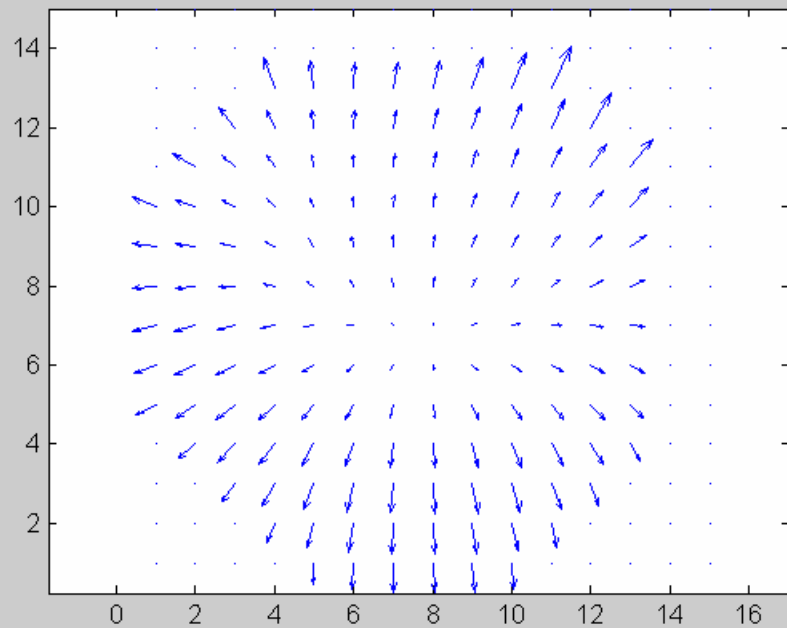
1890 polynomials, 60th order

Original

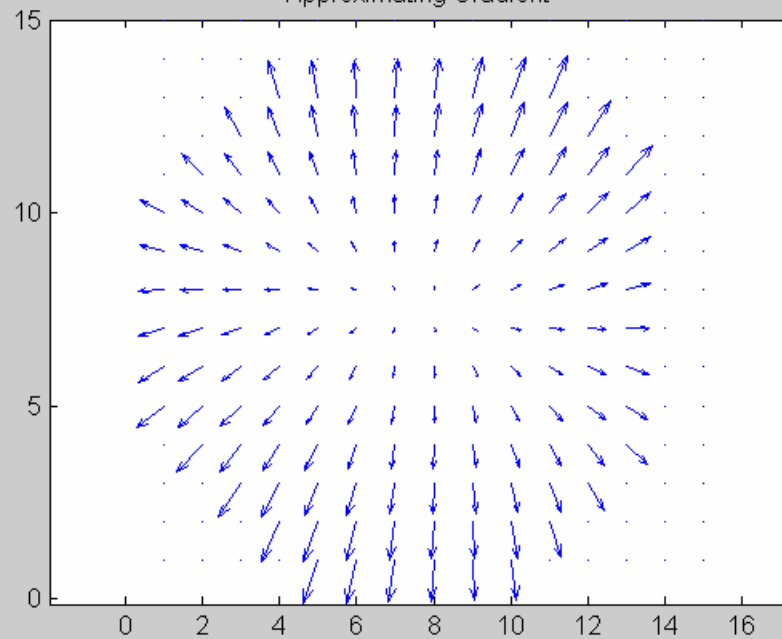


Frits Zernike, Nobel laureate physics 1953

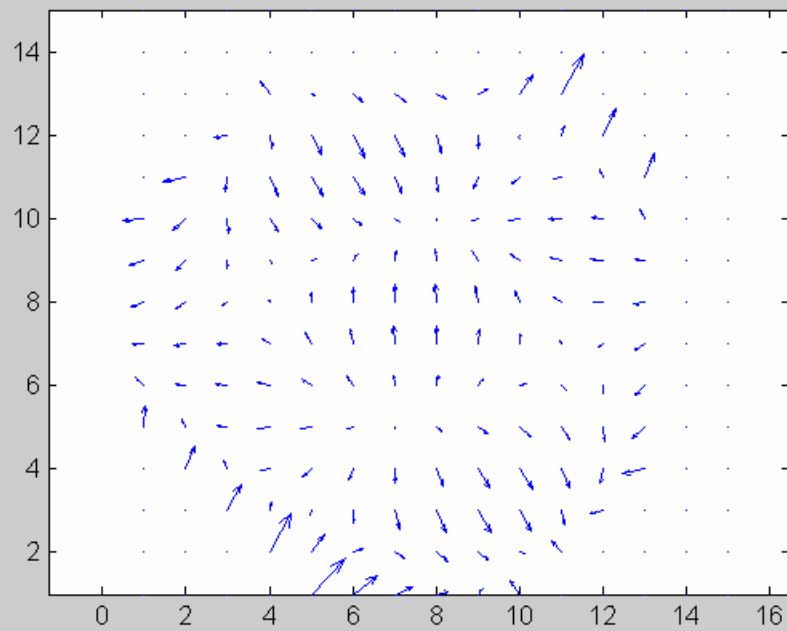
Original Gradient



Approximating Gradient



Gradient Difference



Zernike polynomial

