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Review

Liquid Crystal Devices for Beam Steering Applications

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Supplementary Information on Calculations of Figures of Merit

Section 4.1 introduces three figures of merit ($f_{m=1-3}$). The values of the components f_m for refractive and diffractive devices are given in Table S1 and Table S2, respectively. Given the breadth of literature on the topic, specific articles were chosen to represent techniques where the aim was to show optimized examples of the operating techniques. It was frequently impossible to find precise values for the various parameters, which led to estimates being made. These are marked with an asterisk (*) and were generally obtained through considering other devices where the parameter would be similar or within range. In researching, it was particularly difficult to find values of A_{max} for beam steering devices. For this reason, the value 1 cm^2 was chosen as both the default and maximum choice, as this is standard for an LC device. The literature was then searched to find significant deviations from this value, and these were added where found.

Table S1. Calculations of figures of merit (f_m) in refractive devices. Here, if a parameter (x) tends to increase or reduce with another parameter (y), column x includes $\sim y$ or $\sim\frac{1}{y}$, respectively. These are first order approximations and are frequently not direct power laws.

Device Type	f_1			f_2		f_3	
Parameters	η (%)	θ (°)	τ (ms)	η_{max} (%)	$\Delta\theta_{50}$ (°)	A_{max} (cm^2)	$\eta_{\theta>10}$ (%)
Geometric Prisms and Lenses [1,2]	80* $\sim\frac{1}{d}$	1 $\sim d$	10* $\sim d$	80* $\sim\frac{1}{d}$	1 $\sim d$	1*	0
Fringing Field Refraction Devices [3]	80* $\sim 1/d$	0.1 $\sim d$	100* $\sim d$	80*	0.2	0.01* $\sim 1/\eta$	0*
Alignment Prisms/Lenses [4]	80*	0.2	10*	80*	0.2	1	0
Reflective EASLM[5,6]	99 90 25 $\sim 1/\theta$	0.1 1 10 $\sim 1/\eta$	10	99	6	1	0
Optical Waveguides [7]	80	40	0.1	80	40	0.004 (20 μm × 2 *cm*)	80

Table S2. Calculations of figures of merit (f_m) in diffractive devices. The proportionality between parameters is shown in the same fashion as in Table S1.

Device Type	f_1			f_2		f_3	
Parameters	η (%)	θ (°)	τ (ms)	η_{max} (%)	$\Delta\theta_{50}$ (°)	A_{max} (cm²)	$\eta_{\theta>10}$ (%)
Dielectric Inclusions and Exclusions [8]	80	10 ~d	10	80	0	1	80
Single Patterned Electrode [9]	30	10*	2	30	0	1	30
Diffractive EASLM[5,6]	90 25 ~1/ θ	1 10 ~1/η	10	99	6	1	25
SAL Gratings [10]	68	0.2	10*	68	0	0.01*	0
Photoconductive gratings [11]	35	2*	10000	35	2*	1*	0
PB gratings [12]	100	40	1	100	0	1	100
EHDI Gratings [13]	15 ~1/d	8 ~1/d	1000	15	4	1	4
VBGs [12,14]	90	50	20	90	0	1	90
N* GM E-field [15]	25	7	100*	N/A	3	1*	N/A
N* DM E-field [15]	15*	12	100*	25	0	1*	N/A

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