

*initialization
of parameters*

Incident pump field E_o
Initial phase pattern ϕ
Target field T

SLM plane

$$E_{\text{in}} = E_o e^{i\phi}$$

*output plane
(far field)*

$$E_{\text{out}} = \mathcal{F}\{E_{\text{in}}^2\}$$
$$C \propto \left[1 - \sum_{\text{pixels}}^* \Re\{\bar{T} \cdot E_{\text{out}}\} \right]^2$$

*minimization
(k^{th} iteration)*

- Calculate steepest descent direction ($\mathbf{g}$)

$$\mathbf{g}_k = -\nabla C$$

- Calculate conjugate direction $\mathbf{d}$.

$k = 1$	$k \neq 1$
$\mathbf{d}_k = \mathbf{g}_k$	$\mathbf{d}_k = \mathbf{g}_k + \left(\frac{\mathbf{g}_k \cdot \mathbf{g}_k}{\mathbf{g}_{k-1} \cdot \mathbf{g}_{k-1}} \right) \mathbf{d}_{k-1}$

- Minimize C along $\mathbf{d}$ by changing phase values to reach $\phi_{\min}$.

*feedback
& export*

- Using $\phi_{\min}$ calculate E_{in} , E_{out} , and C for the next iteration.
- If cost (C) has stagnated, the $\phi_{\min}$ is optimized.
- Apply phase compression to final $\phi_{\min}$ for zero-order suppression.
- Convert to 8-bit BMP format and export to SLM.