1.

Given

$$g_1 = f_1 + h_2 * f_2 \quad \text{— (1)}$$

$$g_2 = f_2 + h_1 * f_1 \quad \text{— (2)}$$

h_1, h_2 are known blur kernels

g_1, g_2 are also known.

Need to determine f_1, f_2, which are scene outside and scene inside respectively.

From (1) and (2), applying Fourier Transform,

Let $F(g_i) = G_i$, $F(f_i) = F_i$, $F(h_i) = H_i$ for $i = 1, 2$

$$F(g_1) = F(f_1) + F(h_2 * f_2)$$

$$G_1 = F_1 + H_2 F_2 \quad \text{— (3)}$$

$$\because F(h_2 * f_2) = F(h_2) \cdot F(f_2)$$

$$G_2 = F_2 + H_1 F_1 \quad \text{— (4)}$$

(3), (4) $\Rightarrow$ $G_1 = F_1 + H_2(G_2 - H_1 F_1)$

$$\hat{F}_1 = \frac{G_1 - H_2 G_2}{1 - H_1 H_2} \qquad \hat{F}_2 = \frac{G_2 - H_1 G_1}{1 - H_1 H_2}$$

$$f_1 = F^{-1}\left(\frac{G_1 - H_2 G_2}{1 - H_1 H_2}\right) \qquad f_2 = F^{-1}\left(\frac{G_2 - H_1 G_1}{1 - H_1 H_2}\right)$$

Problem with above formula for f_1, f_2:

h_1 and h_2 are blur kernels.

So, H_1, H_2 are low-pass filters and

$H_1 \to 1$ and $H_2 \to 1$ for low frequencies.

This leads to $(1 - H_1 H_2) \to 0$ for low frequencies

The value $\frac{G_1 - H_2 G_2}{1 - H_1 H_2}$, denominator becomes very small and whole value blows up. This will amplify the noise even if a small amount is present. Natural images have high contribution from low frequency component. With this method, it is difficult to extract them.