

**14.3 FREQUENCIES AND ORIENTATION IN 2D**

**Table 14.1**

2D windowing functions. The functions  $w(u, v)$  have their maximum values at the image center,  $w(M/2, N/2) = 1$ . The values  $r_u$ ,  $r_v$ , and  $r_{u,v}$  used in the definitions are specified at the top of the table.

Definitions:	
$r_u = \frac{u-M/2}{M/2} = \frac{2u}{M} - 1 \quad r_v = \frac{v-N/2}{N/2} = \frac{2v}{N} - 1 \quad r_{u,v} = \sqrt{r_u^2 + r_v^2}$	
<b>Elliptical window:</b>	$w(u, v) = \begin{cases} 1 & \text{for } 0 \leq r_{u,v} \leq 1 \\ 0 & \text{otherwise} \end{cases}$
<b>Gaussian window:</b>	$w(u, v) = e^{\left(\frac{-r_{u,v}^2}{2\sigma^2}\right)}, \quad \sigma = 0.3 \dots 0.4$
<b>Super-Gaussian window:</b>	$w(u, v) = e^{\left(\frac{-r_{u,v}^n}{\kappa}\right)}, \quad n = 6, \kappa = 0.3 \dots 0.4$
<b>Cosine<sup>2</sup> window:</b>	$w(u, v) = \begin{cases} \cos\left(\frac{\pi}{2}r_u\right) \cdot \cos\left(\frac{\pi}{2}r_v\right) & \text{for } 0 \leq r_u, r_v \leq 1 \\ 0 & \text{otherwise} \end{cases}$
<b>Bartlett window:</b>	$w(u, v) = \begin{cases} 1 - r_{u,v} & \text{for } 0 \leq r_{u,v} \leq 1 \\ 0 & \text{otherwise} \end{cases}$
<b>Hanning window:</b>	$w(u, v) = \begin{cases} 0.5 \cdot [\cos(\pi r_{u,v}) + 1] & \text{for } 0 \leq r_{u,v} \leq 1 \\ 0 & \text{otherwise} \end{cases}$
<b>Parzen window:</b>	$w(u, v) = \begin{cases} 1 - 6r_{u,v}^2 + 6r_{u,v}^3 & \text{for } 0 \leq r_{u,v} < 0.5 \\ 2 \cdot (1 - r_{u,v})^3 & \text{for } 0.5 \leq r_{u,v} < 1 \\ 0 & \text{otherwise} \end{cases}$