Figure 1.7 The CIE 1976 Uniform Chromaticity Scale diagram (from the IESNA Lighting Handbook)

1.4.2 The CIE colour spaces

All chromaticity diagrams are of limited value for quantifying colour differences because such diagrams are two-dimensional, considering only the hue and saturation of the colour. To completely describe a colour a third dimension is needed, that of brightness for a self-luminous object and lightness for a reflecting object. In 1964, the CIE introduced the $U^\star$, $V^\star$, $W^\star$ colour space for use with surface colours, where

$$U^\star = 13\ W^\star\ (u - u_n)$$
$$V^\star = 13\ W^\star\ (v - v_n)$$
$$W^\star = 25\ Y^{0.33} - 17 \text{ (where } Y \text{ has a range from 1 to 100)}$$

$W^\star$ is called a lightness index and approximates the Munsell value of a surface colour (see Section 1.4.7). The coordinates u, v, refer to the chromaticity coordinates of the surface colour in the CIE 1960 UCS diagram while the chromaticity coordinates u_n, v_n refer to a spectrally neutral colour lit by the source, that is placed at the origin of the $U^\star$, $V^\star$ system. This $U^\star$, $V^\star$, $W^\star$ system is little used now, about the only purpose for which it is routinely used is the calculation of the CIE colour rendering indices (see Section 1.4.4). For other purposes, the $U^\star$, $V^\star$, $W^\star$ colour space has been superseded by two other colour spaces known by the initialisms CIELUV and CIELAB.