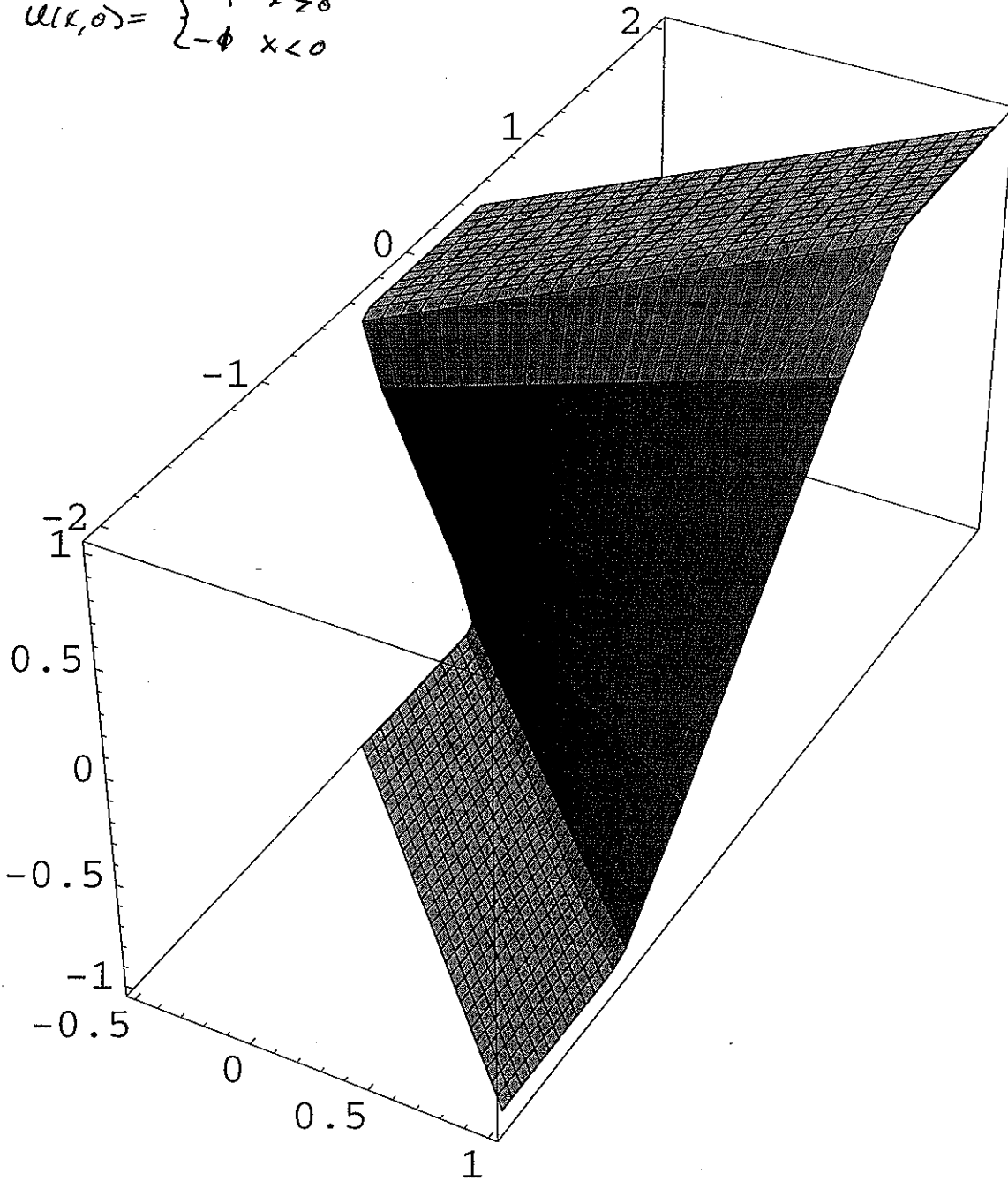


Envelope for family of lines

$$\cos \theta Y + \sin \theta X = 1$$

$$u_t + uu_x = 0$$

$$u(x,0) = \begin{cases} 1 & x \geq 0 \\ -1 & x < 0 \end{cases}$$



This is a plot of the characteristics for the Burger's equation with the initial data $u_0(x) = \text{sgn}(x)$. Note that for $t < 0$ the surface is not a single-valued function, while for $t > 0$ we see the fan connecting the two characteristic surfaces.