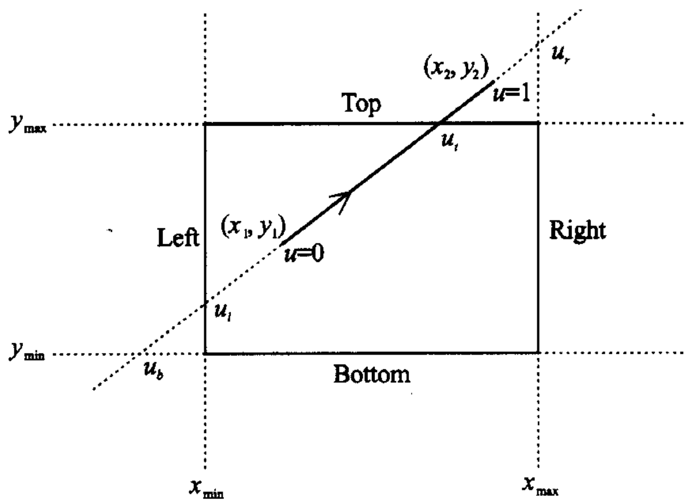

Fig. 5-6

Now consider the tools we need to turn this basic idea into an efficient algorithm. For point (x, y) inside the clipping window, we have

$$x_{\min} \le x_1 + \Delta x \cdot u \le x_{\max}$$
$$y_{\min} \le y_1 + \Delta y \cdot u \le y_{\max}$$

Rewrite the four inequalities as

$$p_k\, u \le q_k, \qquad k = 1, 2, 3, 4$$

where

$$\begin{array}{lll} p_1 = -\Delta x & q_1 = x_1 - x_{\min} & \text{(left)} \\ p_2 = \Delta x & q_2 = x_{\max} - x_1 & \text{(right)} \\ p_3 = -\Delta y & q_3 = y_1 - y_{\min} & \text{(bottom)} \\ p_4 = \Delta y & q_4 = y_{\max} - y_1 & \text{(top)} \end{array}$$

Observe the following facts:

- if $p_k = 0$, the line is parallel to the corresponding boundary and

$$\begin{cases} \text{if } q_k < 0, & \text{the line is completely outside the boundary and can be eliminated} \\ \text{if } q_k \ge 0, & \text{the line is inside the boundary and needs further consideration,} \end{cases}$$

- if $p_k < 0$, the extended line proceeds from the outside to the inside of the corresponding boundary line,
- if $p_k > 0$, the extended line proceeds from the inside to the outside of the corresponding boundary line,
- when $p_k \ne 0$, the value of u that corresponds to the intersection point is q_k/p_k.

The Liang–Barsky algorithm for finding the visible portion of the line, if any, can be stated as a four-step process:

1. If $p_k = 0$ and $q_k < 0$ for any k, eliminate the line and stop. Otherwise proceed to the next step.
2. For all k such that $p_k < 0$, calculate $r_k = q_k/p_k$. Let u_1 be the maximum of the set containing 0 and the calculated r values.
3. For all k such that $p_k > 0$, calculate $r_k = q_k/p_k$. Let u_2 be the minimum of the set containing 1 and the calculated r values.
4. If $u_1 > u_2$, eliminate the line since it is completely outside the clipping window. Otherwise, use u_1 and u_2 to calculate the endpoints of the clipped line.