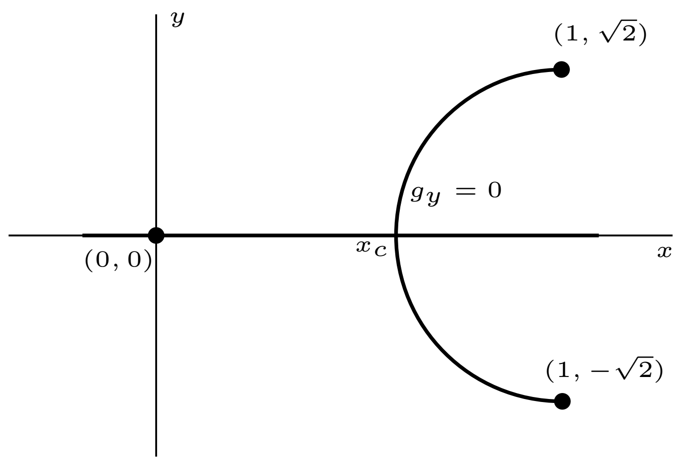

FIGURE 1. The form of the set $g_y(x,y) = 0$

1. ABSTRACT

We consider the problem of finding heteroclinic solutions $x(s),\ y(s)$, of the singularly perturbed system

$$\begin{array}{rcl} x'' & = & g_x(x,y) \\ \epsilon^2 y'' & = & g_y(x,y) \end{array} \tag{1.1}$$

$$x = x(s)\ ,\quad y = y(s)\ ,\quad s \in \mathbb{R}\ ,\quad ' = \frac{d}{ds}$$

which are approximated, when ϵ is small, by a non-smooth connection for the formal limiting system obtained by setting $\epsilon = 0$. The irregularity in the formal limit arises due to the branching nature of the set of solutions (x,y) of the degenerate relation $0 = g_y(x,y)$ (see Fig. 2). Thus the critical manifold will have a "corner" singularity. The salient features of the function g are
(i) $g(x,y) = g(x,-y),\ \ \forall (x,y) \in \mathbb{R}^2$. (This assumption is for convenience only.)
(ii) g has three nondegenerate equal global minima at $(0,0)$, (x_1,y_1), and $(x_1,-y_1)$, where $x_1 > 0$, and $y_1 > 0$. Without loss of generality, we assume that $g(0,0) = g(x_1,y_1) = g(x_1,-y_1) = 0$.
(iii) There exists a continuous function, with finitely many points of nondifferentiability $Y : [-\delta, x_1+\delta] \to [0,\infty)$, $\delta > 0$ small, such that $Y(0) = 0$, $Y(x_1) = y_1$, $g_y(x,Y(x)) = 0$, $\forall x \in [-\delta, x_1+\delta]$ and $g(x,Y(x)) \neq 0$, $\forall x \in (0,x_1)$.

We show existence of solutions $(x,y) \in C^2(\mathbb{R}) \times C^2(\mathbb{R})$ of (1.1) which satisfy

$$(x(-\infty), y(-\infty)) = (0,0) \quad \text{and} \quad (x(\infty), y(\infty)) = (x_1,y_1) \tag{1.2}$$

and their projection on the $x-y$ plane converges as $\epsilon \to 0$ to the set $\{(x,Y(x)),\ x \in (0,x_1)\}$.