On solvability and unsolvability of the problem on transitional solutions for second order nonlinear differential equations

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The second order nonlinear differential equation

$$u'' = f(t, u, u') \tag{1}$$

is considered, where $f : \mathbb{R} \times [0, 1] \times \mathbb{R} \to \mathbb{R}$ is a continuous function such that $f(t, 0, 0) = f(t, 1, 0) = 0$ for $t \in \mathbb{R}$, and for this equation the problem on so-called transitional solutions, i. e. solutions satisfying the conditions

$$\lim_{t\to-\infty} u(t) = 0, \quad \lim_{t\to+\infty} u(t) = 1, \quad 0 \le u(t) \le 1 \ \text{ for } \ t \in \mathbb{R} \tag{2}$$

is studied. New sufficient conditions for solvability and unsolvability of problem (1), (2) are established.

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