Nonlinear eigenvalue problems

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We consider two-parametric eigenvalue problems of the form

$$x'' = -\lambda f(x^+) + \mu g(x^-), \quad x(0) = 0,\ x(1) = 0, \quad |x'(0)| = 1, \tag{1}$$

where $f, g \in C^1([0, +\infty), [0, +\infty))$, $x^+ = \max\{0, x\}$, $x^- = \max\{0, -x\}$, $f(0) = g(0) = 0$. We are looking for (λ, μ) such that the problem (1) has a nontrivial solution. In our considerations functions f and g may be nonlinear functions of super-, sub- and quasi-linear growth in various combinations. The form of spectra depends on monotonicity properties of the functions $\xi t_1(\xi)$ and $\eta\tau_1(\eta)$, where $t_1(\xi)$ and $\tau_1(\eta)$ are the first zero functions for the Cauchy problems $x'' = -f(x)$, $x(0) = 0$, $x'(0) = \xi > 0$, $y'' = g(-y)$, $y(0) = 0$, $y'(0) = -\eta$, $(\eta > 0)$ respectively.