Existence results for system of differential equations involving homeomorphism

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We discuss the existence of solution to the system of differential equations

$$(\phi(u'))' = f(t, u, u')$$

with nonlinear boundary conditions

$$g(u(0), u, u') = 0, \quad h(u'(1), u, u') = 0,$$

where $f : [0,1] \times \mathbb{R}^n \times \mathbb{R}^n \to \mathbb{R}^n$, $g, h : \mathbb{R}^n \times C([0,1], \mathbb{R}^n) \times C([0,1], \mathbb{R}^n) \to \mathbb{R}^n$ are continuous, $\phi : \prod_{i=1}^n (-a_i, a_i) \to \mathbb{R}^n$, $0 < a_i \leq +\infty$, $\phi(s) = (\phi_1(s_1), \ldots, \phi_n(s_n))$ and $\phi_i : (-a_i, a_i) \to \mathbb{R}$ is a one dimensional regular or singular homeomorphism. The method is to apply the concept of the lower and upper solutions. The talk is based on a joint paper with J. Rodríguez–López and K. Szymańska–Dębowska [1].

References

[1] J. Rodríguez–López, K. Szymańska–Dębowska and M. Zima, Lower and upper solutions for system of differential equations involving homeomorphism and nonlinear boundary conditions, *Results Math.* (2024), 79:181.