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CHARACTERIZATION OF OPTIMALITY AND DUALITY FOR A CLASS OF INTERVAL-VALUED SEMI-INFINITE VARIATIONAL PROBLEMS

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Abstract. Our objective in this article is to focus our study on a class of interval-valued semi-infinite variational problems (IVSVP for brevity). First of all, we establish the necessary optimality condition for the problem (IVSVP). Next, we establish sufficient optimality conditions by utilizing the (Φ, ρ)-invexity assumptions. Additionally, we develop weak, strong, and strict converse duality theorems for Mond Weir-type and Wolfe-type dual problems for (IVSVP). Furthermore, we define the Lagrangian function for the considered interval-valued semi-infinite variational problem and present some relations between an LU-optimal solution and a saddle point of the Lagrangian function. Some nontrivial examples are also exemplified to validate our results numerically.

Keywords. Interval-valued problem, semi-infinite variational problem, LU-optimal solution, optimality conditions, duality, saddle point, (Φ, ρ)-invexity.

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1 Introduction

In many real-world mathematical optimization problems, the coefficients are uncertain or imprecise. Uncertainty can be modeled in various ways, such as using fuzzy programming, stochastic programming, and interval programming. However, when there is insufficient data, finding a suitable membership function or probability distribution can be challenging, especially when the data is limited. The interval-valued mathematical optimization problem, also known as interval-coefficient programming, addresses uncertain optimization problems where only the range (or interval) of coefficients is known, rather than their exact values. It also serves as the basis for many contemporary uses, such as automobile suspensions [7], interval optimization in engineering design [8], batch extractive distillation viability [12], interval-valued cooperative game [14], inventory model [18], robot reachability to an object [21], etc.

Numerous techniques have been created in recent years to deal with interval-valued optimization problems. A new nonlinear interval number programming method with high optimization efficiency and wide applicability was developed by