

# General convergence for self-dual approximations to Fully Convex Bolza Problems over Arcs of Bounded Variarion

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Fully convex Bolza problems encompass a Lagrangian that is jointly convex in the state and velocity variables. Rockafellar and collaborators have established existence results under coercivity and without state constraints on the space of absolutely continuous functions. However, state constraints and a lack of coercivity are dual properties in convex analysis. Therefore, when addressing nontrivial state problems, both primal and dual problems are well-posed on the space of functions of bounded variation (BV). We adopt a framework using Goebel's self-dualizing technique [Goe08] to regularize both primal and dual problems simultaneously, approximating them while maintaining the duality relationship. We provide a specific example of duality on BV and present two main convergence results. Finally, we pose two open questions, one of which has partial results proven at the moment.

We refer the reader to [Roc76] for duality results on BV.

[Goe08] Rafal Goebel. Self-dual smoothing of convex and saddle functions. *Journal of Convex Analysis*, 15(1):179, 2008.

[Roc76] R Tyrrell Rockafellar. Dual problems of lagrange for arcs of bounded variation. *Calculus of variations and control theory*, pages 155–192, 1976.