

Existence of minimizers for generalized Lagrangian functionals and a necessary optimality condition – Application to fractional variational problems

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Abstract. We study dynamic minimization problems of the calculus of variations with generalized Lagrangian functionals that depend on a general linear operator K and are defined on bounded-time intervals. Under assumptions of regularity, convexity and coercivity, we derive sufficient conditions ensuring the existence of a minimizer. Finally, we obtain necessary optimality conditions of Euler–Lagrange type. The main results are illustrated with special cases, when K is a general kernel operator and, in particular, with K being the fractional integral of Riemann–Liouville and Hadamard. The application of our results to the recent fractional calculus of variations gives answer to an open question posed in [Abstr. Appl. Anal. 2012, Art. ID 871912; doi:10.1155/2012/871912].

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