The generalized fractional calculus of variations

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We consider variational problems containing generalized fractional integrals and derivatives and study them using standard (indirect) and direct methods.In particular, we obtain necessary optimality conditions of Euler-Lagrange type for the fundamental and isoperimetric problems, natural boundary conditions, and Noether theorems. Existence of solutions is shown under Tonelli type conditions. Moreover, we apply our results to prove existence of eigenvalues, and corresponding orthogonal eigenfunctions, to the fractional Sturm-Liouville problems.