Noether's theorems for variable order fractional variational problems

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In 1993, Samko and Ross proposed an interesting generalization of fractional operators. Namely, they introduced the study of fractional integration and differentiation when the order is not a constant but a function. With time several works were dedicated to variable order fractional operators and many interesting applications of those fractional operators were proposed, e.g., in mechanics and in the theory of viscous flows. Recently, also the study of the calculus of variations with variable order fractional operators has been introduced. In this talk we present analogs of Noether's theorems for variable order fractional variational problems. The first theorem guarantees that the invariance of a variational integral with respect to a continuous symmetry transformations that depend on ρ parameters implies the existence of ρ conserved quantities along the Euler–Lagrange extremals. The second Noether theorem asserts that if a variational integral is invariant under transformations parameterized linearly by r arbitrary functions and their derivatives up to a given order m, then there are r identities between Euler–Lagrange expressions and their derivatives up to order m.