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The natures of covariational reasoning in introductory physics¹ ALEXIS OLSHO, CHARLOTTE ZIMMERMAN, SUZANNE WHITE BRAHMIA, University of Washington, ANDREW BOUDREAUX, Western Washington University, TREVOR SMITH, Rowan University — An objective of introductory physics courses is for students to develop quantitative reasoning skills in the context of physics, which includes the ability to characterize physical phenomena quantitatively. Quantification is a process of using established mathematics to invent and relate novel quantities to describe natural phenomena. An important aspect of quantification in physics is *covariational reasoning*, which can be described as holding in mind a fixed relationship among quantities that vary in dynamic situations. For example, one way a simple spring can be quantified is using the internal energy, which covaries with the displacement of the spring. While significant work has been done by mathematics education researchers to define expert-like thinking in mathematics contexts, little has been done to explicitly articulate and describe specific modes of covariational reasoning used by expert physicists. We present our progress in the development of a framework to characterize expert covariational reasoning in introductory physics contexts, a first step toward understanding development of introductory physics student covariational reasoning.

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