

Abstract Submitted
for the APR17 Meeting of
The American Physical Society

Student construction of differential length elements in multivariable coordinate systems: A symbolic forms analysis¹ JOHN THOMPSON, BENJAMIN SCHERMERHORN, University of Maine — Analysis of properties of physical quantities represented by vector fields often involves symmetries and spatial relationships best expressed in non-Cartesian coordinate systems. Many important quantities are determined by integrals that can involve multivariable vector differential quantities. Four pairs of students in junior-level Electricity and Magnetism (EM) were interviewed to investigate their understanding of the structure of non-Cartesian coordinate systems and the associated differential elements. Pairs were asked to construct differential length elements for an unconventional spherical coordinate system. In order to explore how student conceptual understanding interacts with their understanding of the specific structures of these expressions, a symbolic forms framework was used. Analysis of student reasoning revealed both known and novel forms as well as the general progression of students use and combination of symbol templates during the construction process. Each group invoked and combined symbolic forms in a similar sequence. Difficulties with the construction of expressions seem to be related almost exclusively to the conceptual schema (e.g., neglecting the role of projection) rather than with symbol templates.

¹Supported in part by NSF Grant PHY-1405726.

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Date submitted: 27 Sep 2016

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