1054-55-202 **Chad D Giusti*** (cgiusti@uoregon.edu), Department of Mathematics, University of Oregon, Eugene, OR 97403. *Unstable Vassiliev Theory.*

We begin by constructing the spaces of plumbers' knots, which are piecewise linear with all pipes parallel to the axes. These knots are closely related to lattice knots and provide a new version of finite complexity knot theory which, in the limit, gives rise to classical knot theory. The rigid geometry of these spaces induces a combinatorial cellular structure. We exploit this to construct an algorithm for distinguishing the unstable isotopy class of a plumbers' knot. This algorithm has demonstrated that, for example, there are seven components of the space of plumbers' knots with five moves, though only three classical knot types are present.

We next describe the notion of the Vassiliev derivative for a singular plumbers' knot, extending the definition to include singularities other than collections of isolated double-points. This allows us to import Vassiliev's original techniques to our finite-complexity setting, where we can exploit the cell structure to explicitly compute Vassiliev derivatives while retaining geometric information. This result opens the door to constructing new Vassiliev-style knot invariants and/or seeing the strength of finite-type invariants once we understand the behavior of Vassiliev derivatives under stabilization (subdivision of pipes). (Received September 14, 2009)