Meeting: 1001, Evanston, Illinois, SS 15A, Special Session on Mathematical Problems in Robotics

1001-93-374 **Daniel Koditschek*** (kod@umich.edu), 1101 Beal Ave, Ann Arbor, MI 48109, and **Gabriel Lopes**. *Topological Localization and Mapping in the Horizontal Plane via Successive Visual Registration.* Preliminary report.

A monocular camera's view of three beacons provides a landmark for a mobile robot operating in the horizontal plane by interpreting their projection as the diffeomorphic image of the robot's configuration in SE(2). Appropriate navigation functions on the landmark's projections alone give rise to visual servo laws whose closed loop dynamics yield attractors at configurations specified by designated "snapshots" of the landmark and associated basins that include exactly those configurations connected by paths in SE(2) not incurring loss of landmark from camera field of view. We seek composition rules for such visual servo laws that permit topological localization within and, ultimately, mapping of unknown environments affording visually distinctive beacons. By topological localization (and mapping) we mean the ability to move around in (and build a model of) a homeomorphic image of the visually accessible configuration space. The set of visually accessible configurations (the union of all landmark basins) is partitioned into cells characterized by perceptual "symbols" — combinatorially distinct patterns of beacon appearances — whose evolution over the course of the robot's navigation has a very regular structure that we explore and discuss. (Received August 31, 2004)