

# Assembly and Motion Planning

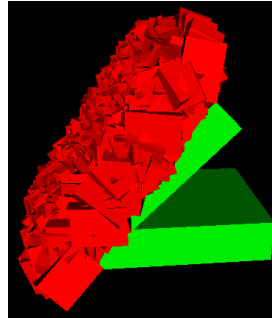
## Chairs: Y. B. Jia, Yuan F. Zheng

### Towards Random Sampling with Contact Constraints

X. Ji and J. Xiao

University of North Carolina, Charlotte

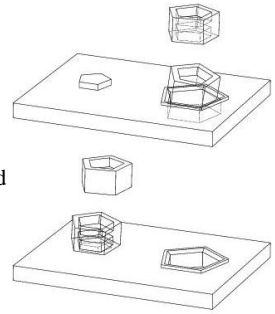
- Randomly sample configurations of polyhedra satisfying contact constraints.
- Directly sample in contact space by exactly calculating the value range for each independent variable.
- Implementation results are reported for contact states consisting of a single principal contact (PC).
- The approach is efficient, and the results can be applied to contact motion planning.



### Determining Feasible Contact States of Pairs of Spatial Polyhedra

Barry Goeree, Ernest Fasse and Michael Marefat  
University of Arizona

- Qualitative contact models are useful for assembly planning.
- Hypothesis testing methods can be used for model generation.
- An optimization-based testing method is presented.
- The method has been applied to non-convex polyhedral pairs.

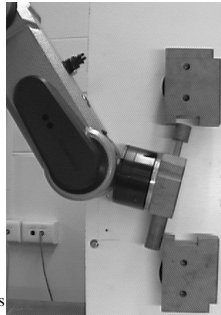


### Programming by Demonstration - Constructing Task Level Plans in a Hybrid Dynamic Framework

J. Chen and B. McCarragher

Australian National University

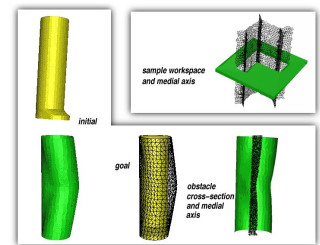
- Most existing Programming by Demonstration approaches allow the robot to repeat suboptimal actions used by the human demonstrator
- We construct an execution plan for the robot from the best 'task-level' strategies used by the human
- We demonstrate the common household task of changing the roll on a paper roll holder. Using the constructed plan the robot performed better than when directly copying the demonstrator
- The approach allows the robot to avoid suboptimal actions that are typically found in human demonstrations



### A Framework for Using the Workspace Medial Axis in PRM Planners

C. Holleman and L. Kavraki  
Rice University

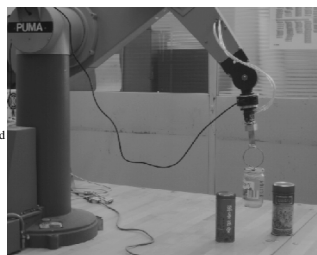
- PRM planners often fail due to narrow passages.
- Sample configurations based on the workspace medial axis.
- We show positive results for two difficult scenarios.
- PRM can be strengthened by incorporating workspace geometry.



### Real-Time Motion Planning for Personal Robots Using Primitive Motions

L. Xu<sup>1</sup> and Y. F. Zheng<sup>2</sup><sup>1</sup>Zhejiang University and <sup>2</sup>The Ohio State University

- This paper is to develop a motion planning mechanism for personal robots to move in unstructured environments. The idea is to reduce the burden to the users in planning low level motions. As a result, the personal robot becomes a convenient tool to elderly and ill people.
- We use primitive motions as basic components for planning the robot motion. The basic components resemble the motion patterns of human hands. The combination of basic motions thus generate motions of the personal robot natural to human beings. Modification to the primitive motions is also developed for the personal robots to cope with obstacles.
- Experiments were conducted on a robotic arm. The results show that the developed mechanism is effective.
- The primitive motion scheme is an important contribution to the development of personal robots. By using this scheme, the robot can generate complex trajectories without being steered all the time. This makes the operation of personal robots easy.



### Attractive Regions in the Environment

H. Qiao

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