

Interactive Generalized Penetration Depth Computation for Rigid and Articulated Models using Object Norm

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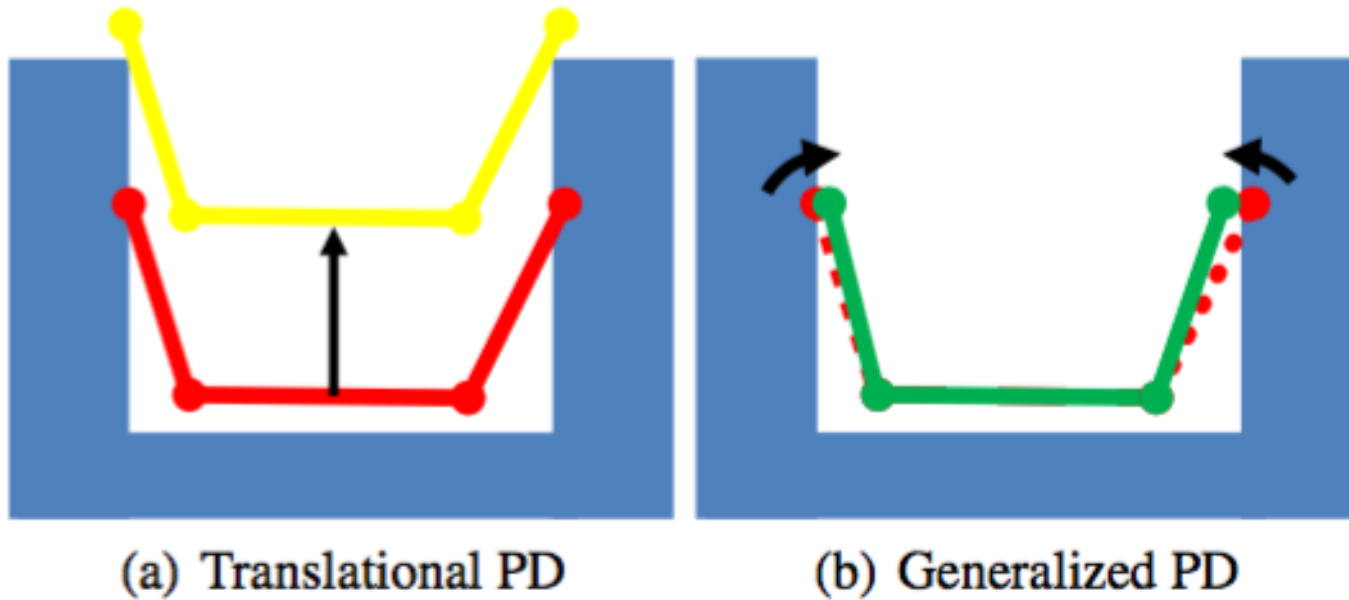
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Overview – key topics

- Penetration depth
- Collision detection
- Articulated models (having joints)
- Algorithms
- Object norm metric

Introduction – Main problem



Main goal

- Create algorithm to accurately approximate generalized penetration depth (PDg) between two overlapping rigid or articulated models

Previous work

- Translational Penetration Depth
 - relatively slow
 - do not run at interactive rates
- Generalized Penetration Depth
 - rather slow for interactive applications
 - not clear whether they are applicable to articulated models

Work

- Object norm - general formulation of distance metric
- Generalized PD computation

Generalized PD computation

- Free-configuration Selection
- Contact-space Projection
- Constrained Optimization
- Re-projection

Suggested applications

- Retraction-based motion planning
- Physically-based animation
- Data-driven grasping

Interactive Generalized Penetration Depth (PDg) Computation

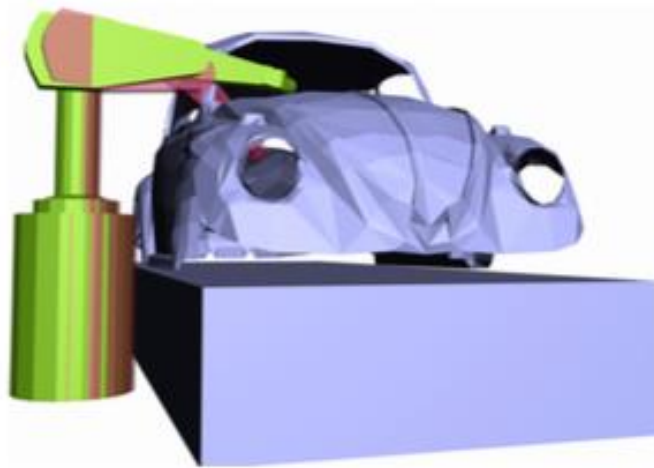


(a) Spoon/Cup



(e) Grasping

PDg Computation for Articulated Models



(a) Puma1

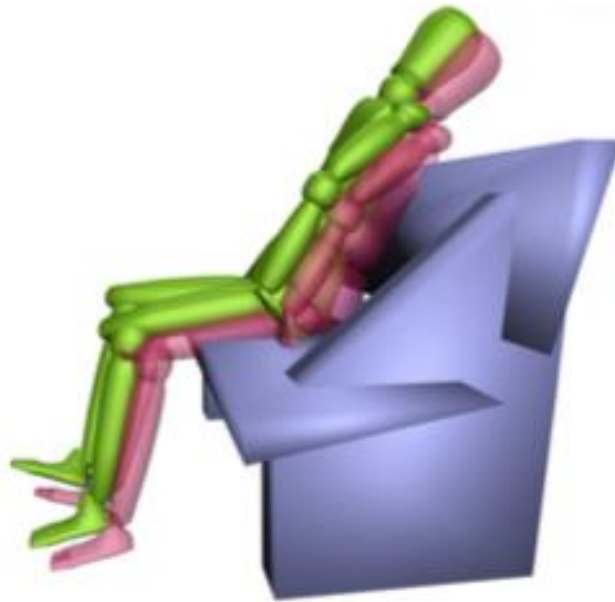


(b) Puma2



(c) Hand

Finding Collision-free Configurations for Articulated-body Dynamics



(a) Bench



(b) Cup

Conclusion and key ideas

- Real-time algorithm to compute generalized penetration depth for rigid and articulated models
- General formulation of distance metric, the object norm
- Different applications - motion planning, physically-based animation and grasping

Future work

- Extension of the generalized PD computation to multiple bodies
- Integration into constraint-based dynamics
- GPU-based or parallel implementations

The End