

# **Recent Advance in Collision/Contact Computation for Haptic Rendering**

**Young J. Kim**  
**Ewha Womans University**

# Speakers

- Young J. Kim
  - Ewha Womans University, Korea
- Dangxiao Wang
  - Beihang University, China
- Jeha Ryu
  - GIST, Korea



# Tutorial Goal

- Expose recent research progress on collision/contact computation
  - Object-space approach
  - Image-space approach
- Integration with haptic rendering
  - Penalty-based
  - Constraint-based

# Schedule

| Title   | Time        | Speaker        |
|---|-------------|----------------|
| Course Intro  | 9:00~9:10   | Young J. Kim   |
| High performance penetration depth computation for haptic rendering         | 9:10~10:00  | Young J. Kim   |
| Q&A or break  | 10:00~10:05 |                |
| Sphere-tree based collision detection for constraint-based haptic rendering | 10:05~10:55 | Dangxiao Wang  |
| Q&A or break  | 10:55~11:00 |                |
| Haptic rendering: depth-image based approach                                | 11:00~11:50 | Jeha Ryu       |
| Q&A   | 11:55~12:00 | Kim, Wang, Ryu |

Some demos will be presented outside during the break and after tutorial

# Haptic Rendering Pipeline



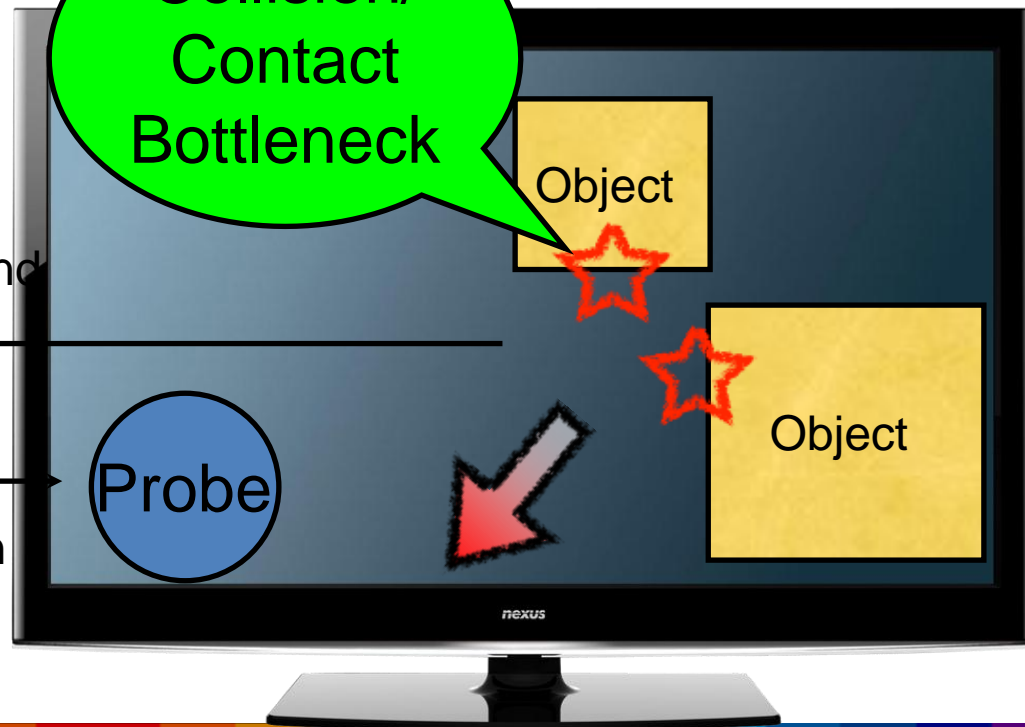
Motion ↓ ↑ Force Feedback



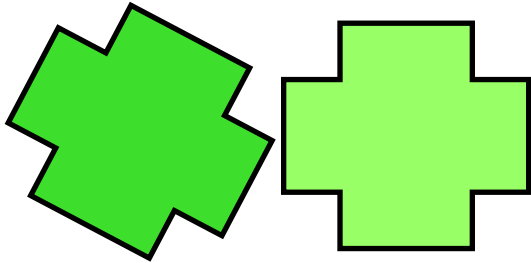
Command

Position

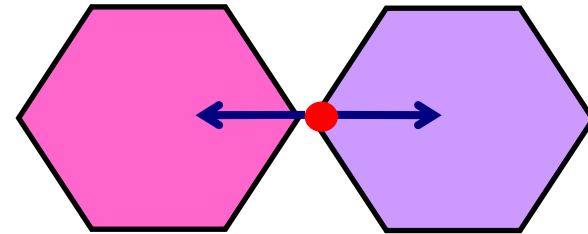
Collision/  
Contact  
Bottleneck



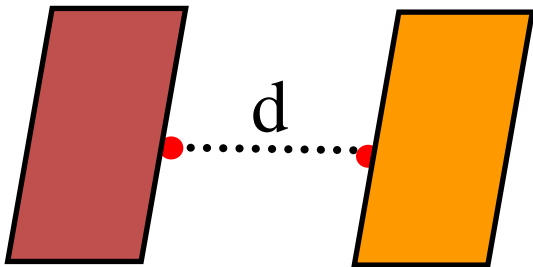
# Collision/Contact Computation



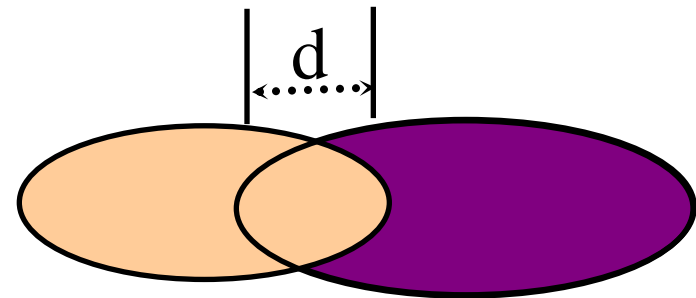
Collision Detection



Contact Points & Normals



Closest Points & Separation Distance



Penetration Depth

# General Approach

- Localize the search space
- Object-space
  - Bounding volume hierarchy (e.g. box, sphere)
  - Spatial partitioning (e.g. octree)
- Image-space
  - Distance fields
  - Depth image

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**<http://graphics.ewha.ac.kr/WHC13>**

Course slides will be available