

A Human-Centered Design Approach for Devices Interacting with Soft Tissue

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Need Statement

- New method of dealing with **massive 3D/4D datasets** (including FEA) and optimization of multiple design parameters.
- **Better user interface based on visualization** to help understand trade-offs between design parameters.
- **Human involvement: designer-in-the-loop** during the design exploration.
- Creation of a **virtual prototyping system**



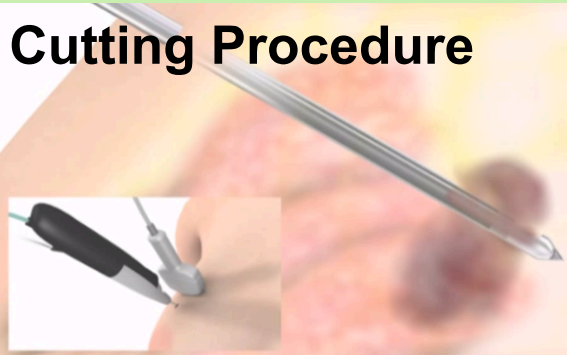
Design a Vacuum-Assisted Breast Biopsy Device

VABB Device



Hologic, Inc., <<http://www.hologic.com>>

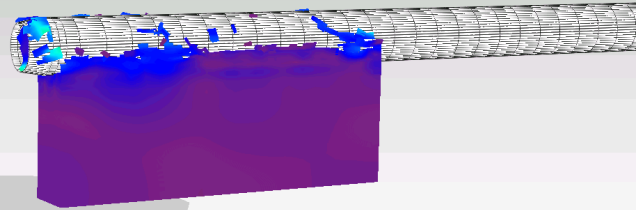
Cutting Procedure



Bupa, <<http://www.bupa.co.uk/>>

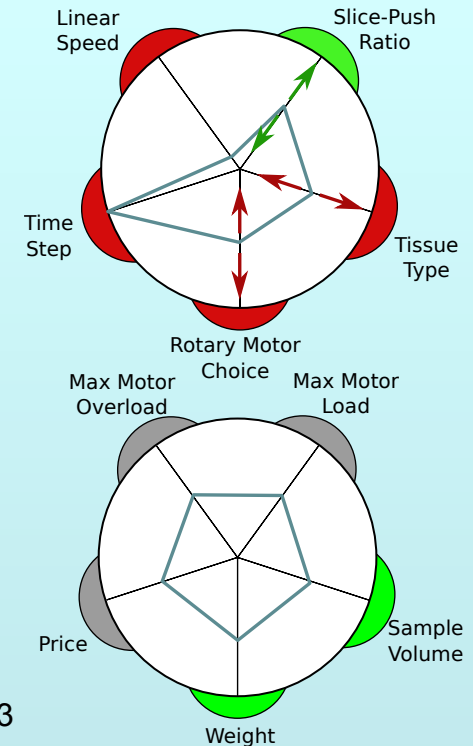
Use Case 1:
Forward and inverse design
by interacting with input
and output Wheel plots

Real-time 3D visualization



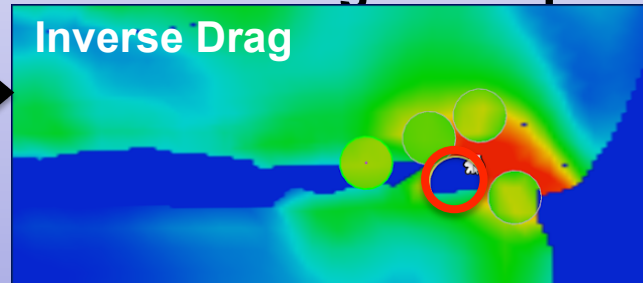
Simulated by ANSYS Explicit STR

Coffey, et al., "Design by Dragging," VCG, IEEE, 2013

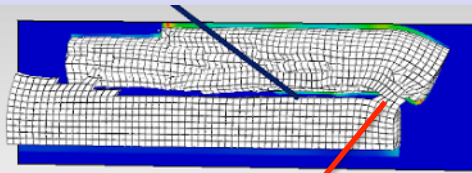


Use Case 2:
Inverse design manipulation on visualization

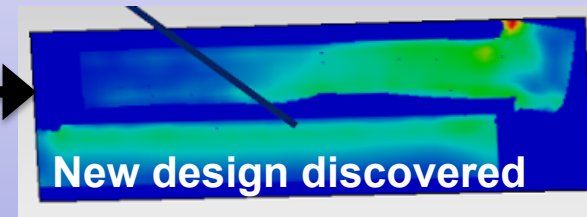
Inverse Drag



New design discovered



Dry tap



Takeaway Message

- We demonstrated a new design approach that:
 - provides a **novel visual display** of a large design solution space.
 - enables exploring entire solution space using **interactive forward and inverse design interfaces**
 - incorporates the **human in the design loop**
- What it offers to future?
 - An interactive **virtual prototyping environment** for medical devices
 - A **new design platform** that experts from different fields can simultaneously join the design optimization

