MIT Class 6.S080 (AUS)

Mechanical Invention through Computation

Iris Structures
Innovative Technology
Radial Aperture (Iris)
Iris Structures

• Circle linkage, 12 scissor pairs

Note collinear condition between red & blue links

retracted

extended
Iris Structures

- Connect 2\textsuperscript{nd} circle linkage to 1\textsuperscript{st}
- Outer pivots of inner linkage connected to inner pivots of outer linkage

retracted

extended
Iris Structures

- Third linkage connected to other two linkages

retracted

extended
Iris structures

- Alternate view of folded geometry – interlocking hexagons
Iris structures

- Constructed circular iris
Iris structures

- Constructed circular iris – note that pivots go through four links (except for inner and outer perimeter, which go through 2 links)
Iris structures

Comparison between two iris scissor constructions

- 30 degree angle has 3 scissors
- 15 degree angle has 6 scissors

Generally, smaller angle has more scissors and achieves greater compression ration when retracted
Iris structures

- Six ring (circular) linkages
- 24 scissors per ring
Iris structures

- Six ring (circular) linkages
- 24 scissors per ring
Iris structures

- Six ring (circular) linkages
- 24 scissors per ring
Iris structures
Iris structures
Iris structures
Iris using links as covering panels
Iris curtain
Structural approach
Structural approach
Iris structures

FIG.36

FIG.37

FIG.38
Olympic Arch, Salt Lake City 2002
Olympic Arch, Salt Lake City 2002
Olympic Arch
Olympic Arch
Olympic Arch
Olympic Arch
Olympic Arch
Olympic Arch
Olympic Arch
Olympic Arch
Olympic Arch
Olympic Arch
Olympic Arch, Salt Lake City 2002
Olympic Arch
Olympic Arch, Salt Lake City 2002
Iris structures – defining by a curve on spherical surface

Tong linkage border is isosceles triangle – surfaces can be defined as shown
Iris (vaulted surface)
Iris (vaulted surface)
Iris (vaulted surface)
Iris - single curvature construction

FIG. 13

FIG. 14

FIG. 15
Iris - single curvature construction
Iris (saddle surface)
Iris (saddle surface)
Iris - single curvature construction
Scale
Support Case 2 Cable Loads
Right & Front Wind Loading (90 MPH)
U2 360 Tour
Iris - double curvature construction
Iris - double curvature construction
Iris - single curvature construction

FIG. 25

FIG. 26

FIG. 27

FIG. 28
Expo 2000, Hannover
Resolving forces between kinematic and structural modes

Stability defined as a process, not a state
Iris - hub construction
Iris structures
Iris structures

- Constructed circular iris
Non-circular iris structures

1. Create similar rhombs within isosceles triangles
2. Connect isosceles regions with similar rhombs

To define retracted position

Alternating regions between Isosceles triangle regions (non-shaded)
Non-circular iris structures
Non-circular iris structures
Non-circular iris structures
Non-circular iris structures
Non-circular iris structures
Non-circular iris structures