RENATA CASTELO BRANCO

ReAD
REPRESENTATIONAL ALGORITHMIC DESIGN

3 CHALLENGES   3 STRATEGIES

ALGORITHMIC DESIGN
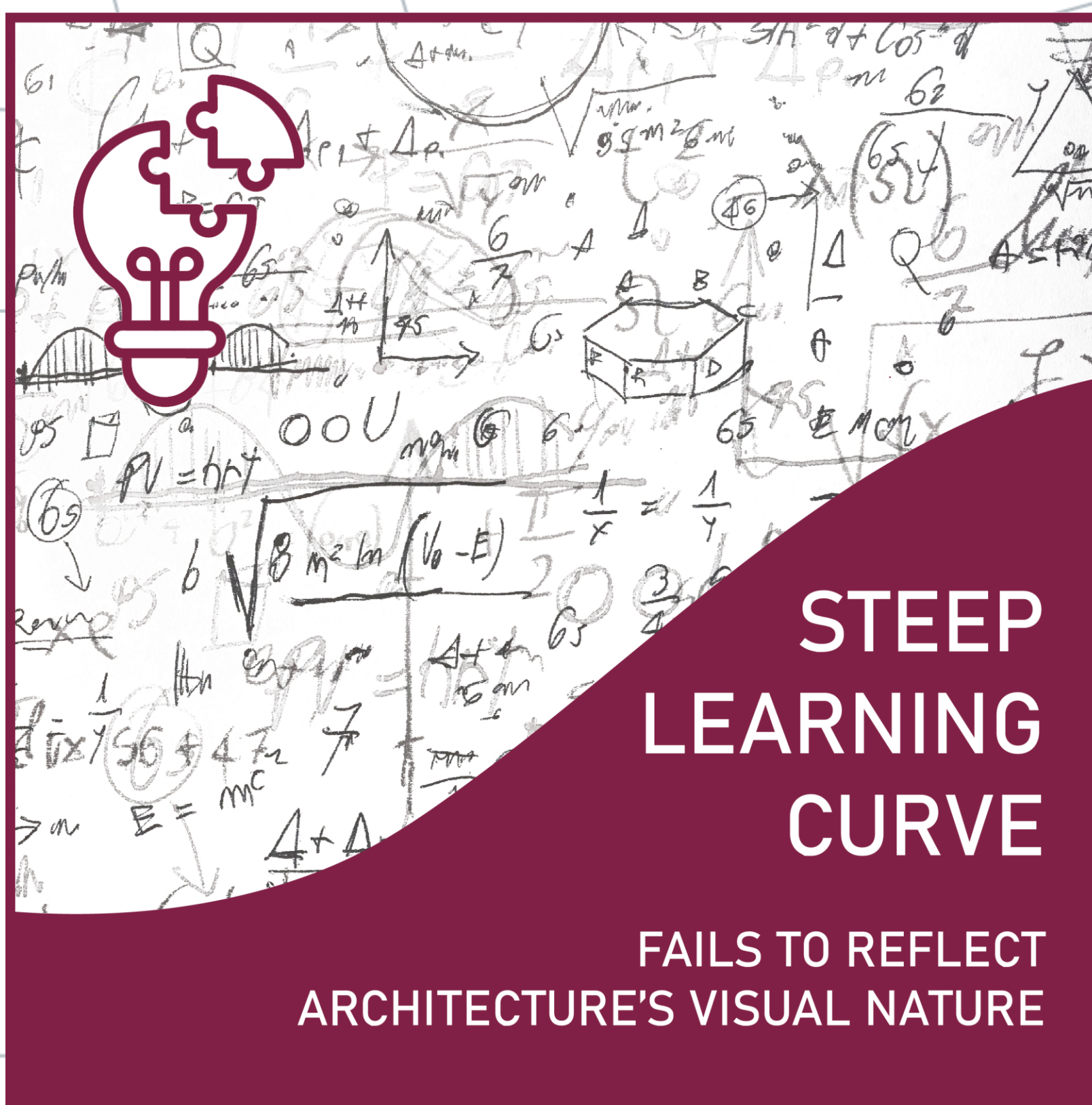
DESIGNING ARCHITECTURAL PROJECTS TROUGH ALGORITHMS

☑ FLEXIBLE DESIGN SOLUTIONS
SUSTAINABLE DEVELOPMENT
PROJECT OPTIMIZATION

❗ REQUIRES PROGRAMMING
IDEs UNSUITED FOR DESIGN

◎ PROMOTE GENERALIZED USE OF ALGORITHMIC DESIGN BY REMOVING LARGEST OBSTACLES

STEEP LEARNING CURVE
FAILS TO REFLECT ARCHITECTURE'S VISUAL NATURE

PROGRAM COMPREHENSION
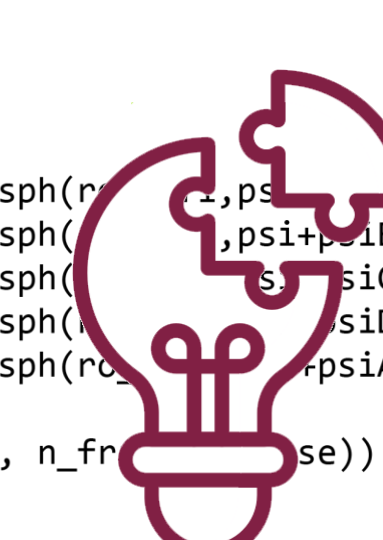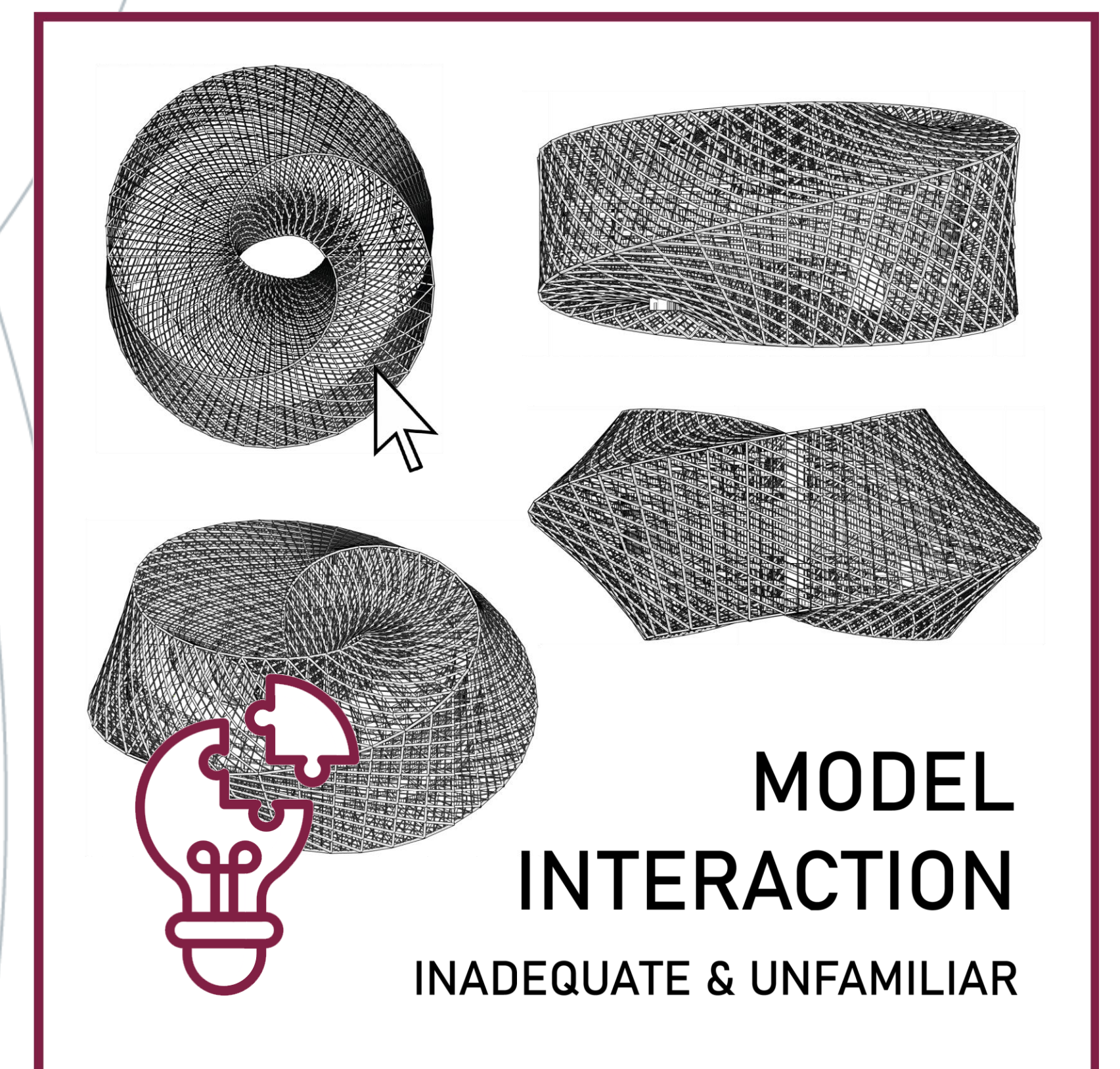HARD TO UNDERSTAND STRUCTURE & BEHAVIOR

```
n_frames = 36
x_divisions = 4
y_divisions = 7
skin_rotataion = pi
frame_x = Parameter(3*block_1)
frame_y = Parameter(3*block_h + 8)
ro_f = sqrt((frame_x()/2)^2 + (frame_y()/2)^2)
psiA = atan(frame_y()/2, frame_x()/2)
psiB = pi - atan(frame_y()/2, frame_x()/2)
psiC = pi + atan(frame_y()/2, frame_x()/2)
psiD = -atan(frame_y()/2, frame_x()/2)

bar(pts) = map(beam, pts[1:end-1], pts[2:end])

frames(p) =
  map((fi, psi) -> bar([rot_base_point(p,fi) + vsph(ro,psi,...,
                        rot_base_point(p,fi) + vsph(...,psi+..B),
                        rot_base_point(p,fi) + vsph(...,psiC),
                        rot_base_point(p,fi) + vsph(...,psiD),
                        rot_base_point(p,fi) + vsph(ro,... + psiA)]),
     division(2*pi, 0, n_frames, false),
     division(-(pi/2), -(pi/2) + skin_rotataion, n_fr...se))

points_in_between(p1, p2, n0, nv) =
  ...
```
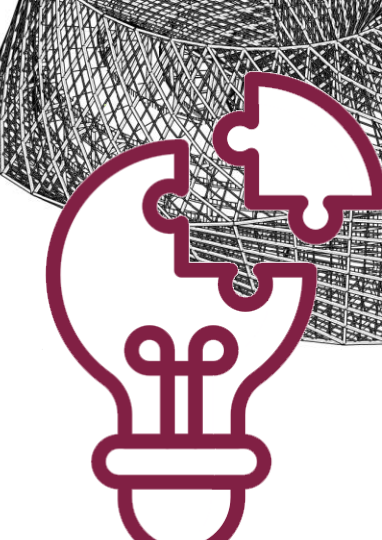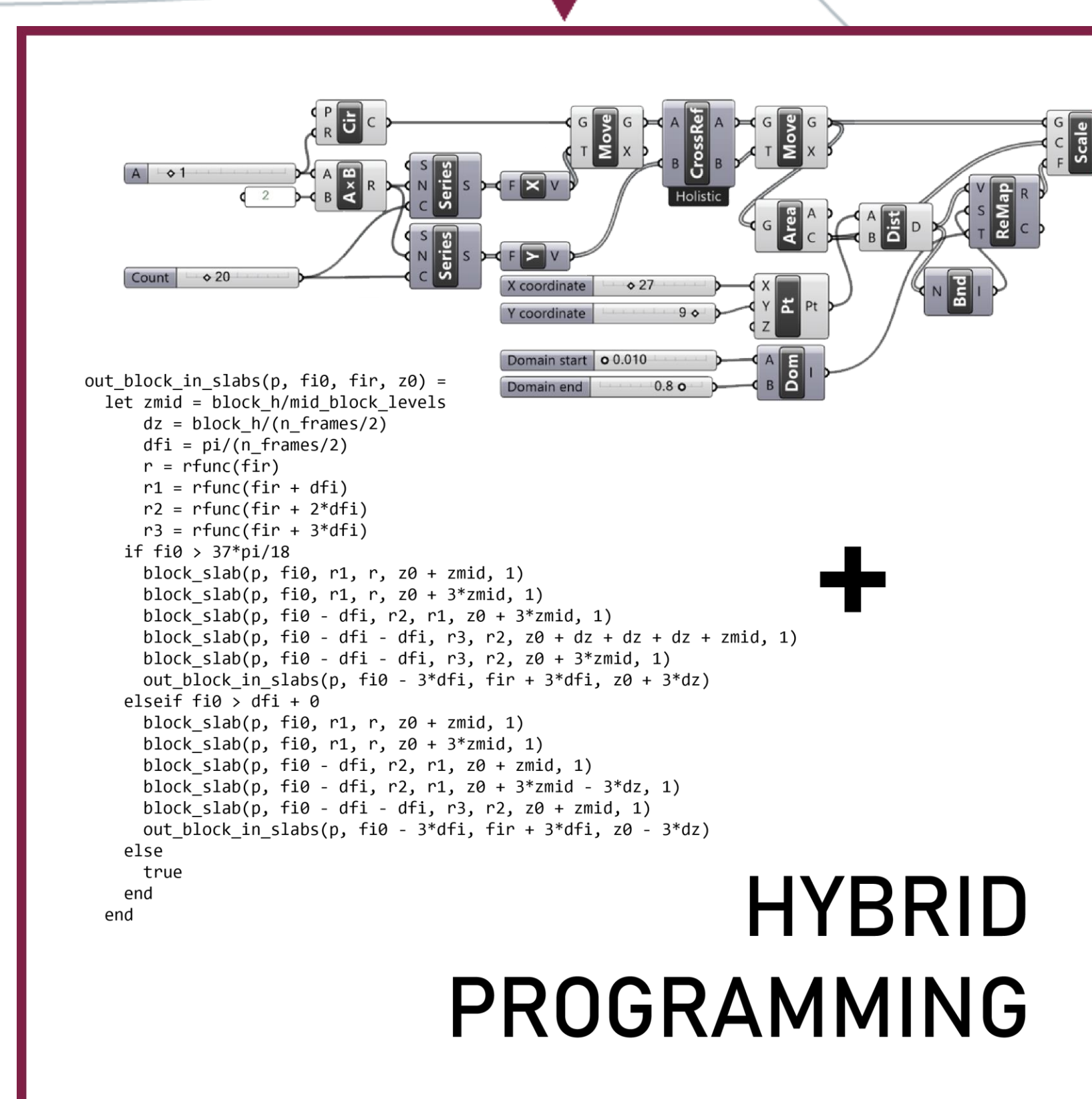
MODEL INTERACTION
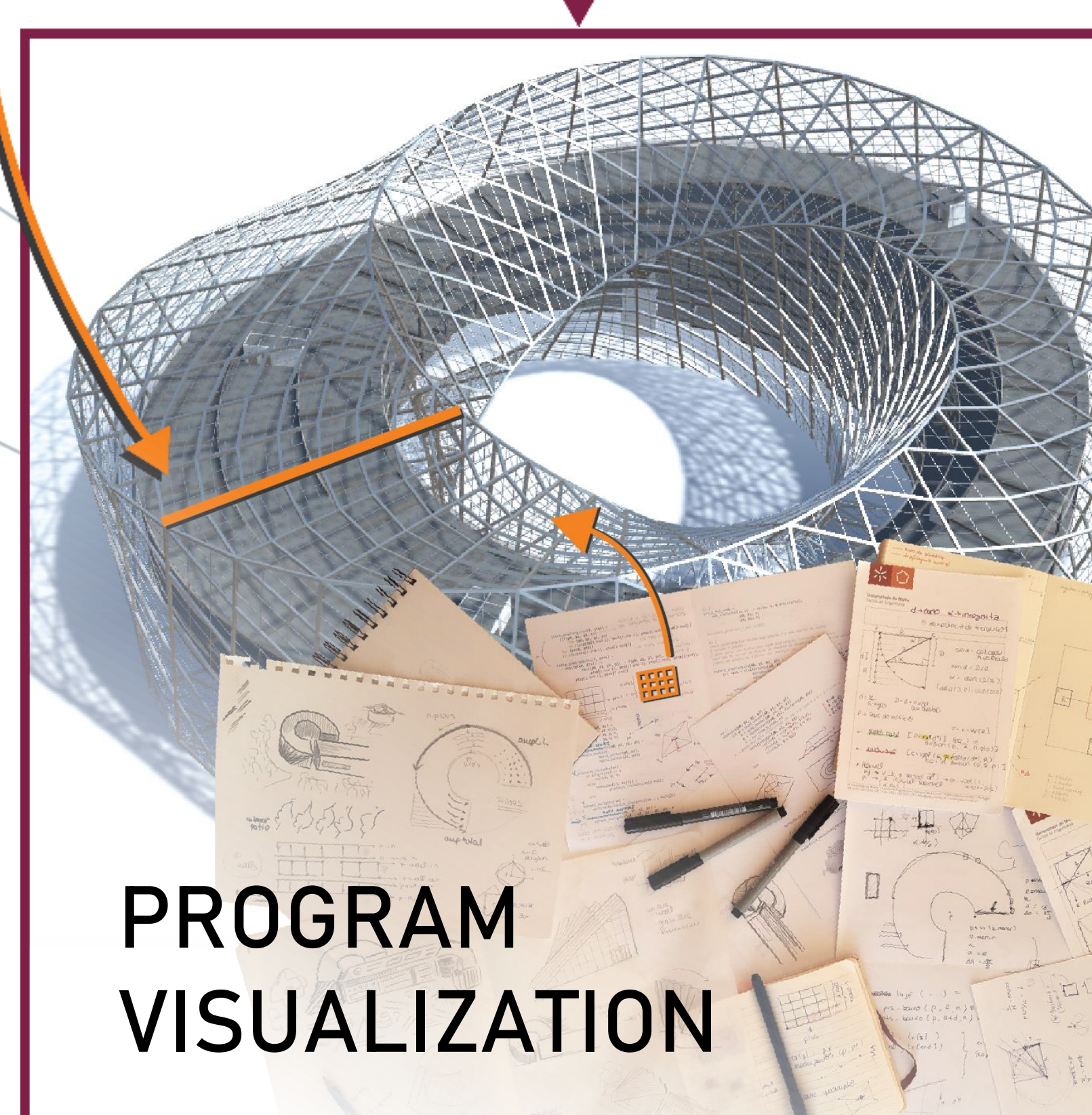INADEQUATE & UNFAMILIAR

```
out_block_in_slabs(p, fi0, fir, z0) =
  let zmid = block_h/mid_block_levels
    dz = block_h/(n_frames/2)
    dfi = pi/(n_frames/2)
    r = rfunc(fir)
    r1 = rfunc(fir + dfi)
    r2 = rfunc(fir + 2*dfi)
    r3 = rfunc(fir + 3*dfi)
  if fi0 > 37*pi/18
    block_slab(p, fi0, r1, r, z0 + zmid, 1)
    block_slab(p, fi0, r1, r, z0 + 3*zmid, 1)
    block_slab(p, fi0, r1, r2, z0 + 3*zmid, 1)
    block_slab(p, fi0 - dfi - dfi, r3, r2, z0 + dz + dz + dz + zmid, 1)
    block_slab(p, fi0 - dfi - dfi, r3, r2, z0 + 3*zmid, 1)
    out_block_in_slabs(p, fi0 - 3*dfi, fir + 3*dfi, z0 - 3*dz)
  elseif fi0 > dfi + 0
    block_slab(p, fi0, r1, r, z0 + zmid, 1)
    block_slab(p, fi0, r1, r, z0 + 3*zmid, 1)
    block_slab(p, fi0 - dfi, r2, r1, z0 + zmid, 1)
    block_slab(p, fi0 - dfi, r2, r1, z0 + 3*zmid - 3*dz, 1)
    block_slab(p, fi0 - dfi - dfi, r3, r2, z0 + zmid, 1)
    out_block_in_slabs(p, fi0 - 3*dfi, fir + 3*dfi, z0 - 3*dz)
  else
    true
  end
end
```
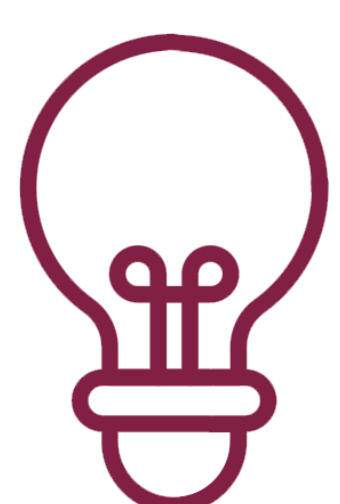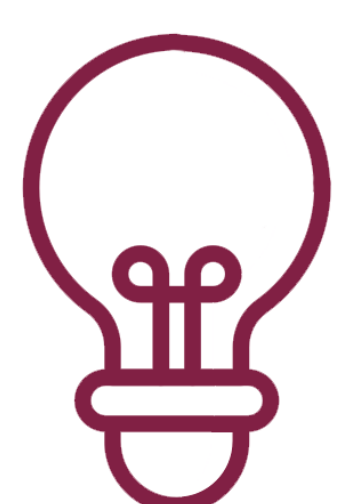
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HYBRID PROGRAMMING

PROGRAM VISUALIZATION

LIVE CODING IN VIRTUAL REALITY

✓ USER-FRIENDLINESS
✓ VISUAL FEATURES
✓ SCALABILITY
✓ PORTABILITY
✓ VISUAL TO TEXTUAL TRANSITION

✓ VISUAL DOCUMENTATION
✓ TRACEABILITY
✓ IMMEDIATE FEEDBACK
✓ GRAPHICAL DATA

✓ VIRTUAL IMMERSION
✓ REAL SCALE NAVIGATION
✓ TACTILE INTERACTION
✓ REMOTE COLLABORATION

THE BUILDING USED TO ILLUSTRATE ReAD IS AN ADAPTATION OF THE ASTANA NATIONAL LIBRARY PROJECT FROM BIG ARCHITECTS

PHD IN COMPUTER SCIENCE AND ENGINEERING

Supervisor: António Menezes Leitão

Nov 2022