TABLES:

Table 1. CRCD Course Decomposition

Nano-scale	Micro-scale	Macro-scale

Lecture Topics:
• Crystal bonding
• Crystal structures
• Crystal mechanical behavior
• Dislocations
• Fracture
• Fracture at Interfaces
	Lecture Topics:
	• Interface cracks
	• Anisotropy
	• Composite fiber-reinforce composites
	  • Stress-free laminate edge problem
	  • Laminate interface singularities
	  • Laminate ply crack singularities
	• Cracks in homogeneous materials:
	  • Isotropic
	  • Anisotropic
	• Wave propagation:
	  • Isotropic
	  • Anisotropic
		Lecture Topics:
		• Stress
		• Equilibrium
		• Strain
		• Material characterization
		• Boundary conditions
		• Work external forces
		• Minimum potential energy
		• Uniqueness theorem
		• Axial bar deformation
		• Beam bending terminal couples

Atomistic modules:
• (01) Ni-Al grain boundary crack
• (02) Vacancy in Iron
	Heterogenous modules:
	• (01,02) Anisotropic polar plots
	• (03,04) Cijkl stiffness tensor glyph
	• (05,08) Linear elastic laminated plate analysis (LELPA)
	• Generalized plane strain edge stress laminate Finite Element Model (FEM)
	  • (06) Nonwoven $[0/\pm 45/90]_s$
	  • (07) Woven $[0/90]_s$
	• Generalized plane strain interior stress laminate Finite Element Model (FEM)
	  • (09) Without interior ply crack
	  • (10) With interior ply crack
	• Singularity Stroh's method
	  • (15a) stress free edge
	  • (15b) laminate ply crack
	• Dynamic mechanical behavior
	  • (18) 1D FEM isotropic
	  • (19) 2D FEM (30x60) anisotropic
	  • (20) 2D FEM (45x180) anisotropic
		Continuum modules:
		• (01) Stresses in thick walled cylinders
		• (02) Brittle-Ductile transition

FIGURES:

Figure 1. Advanced Communications and Information Technology Center located near the center of campus of Virginia Polytechnic Institute and State University, North view showing bridge spanning the mall entrance to the university.

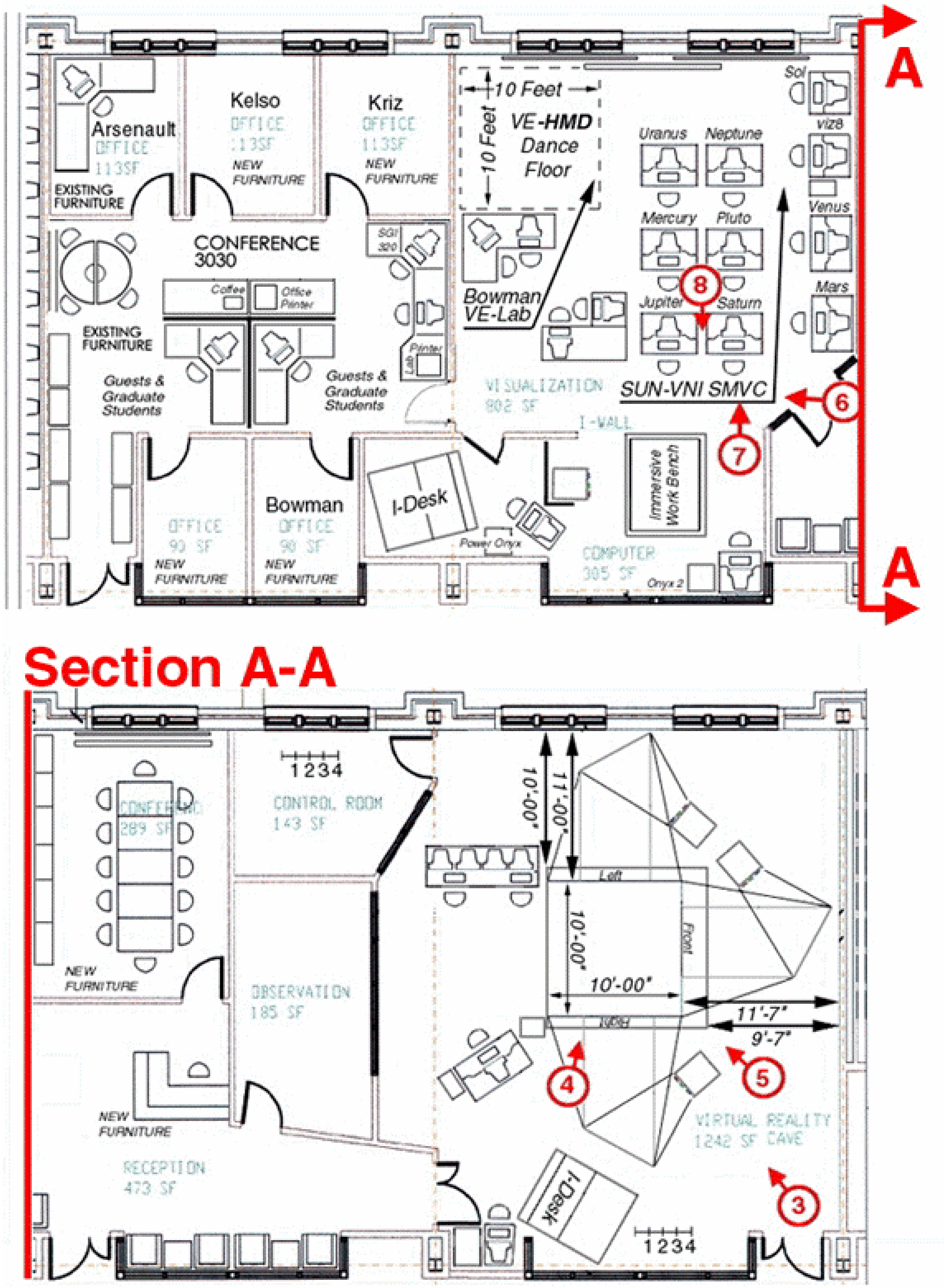

Figure 2. Floor plan third floor of the west wing for University Visualization and Animation Group. Numbers in circles with arrows indicate position and direction of Fig.s 3-8.

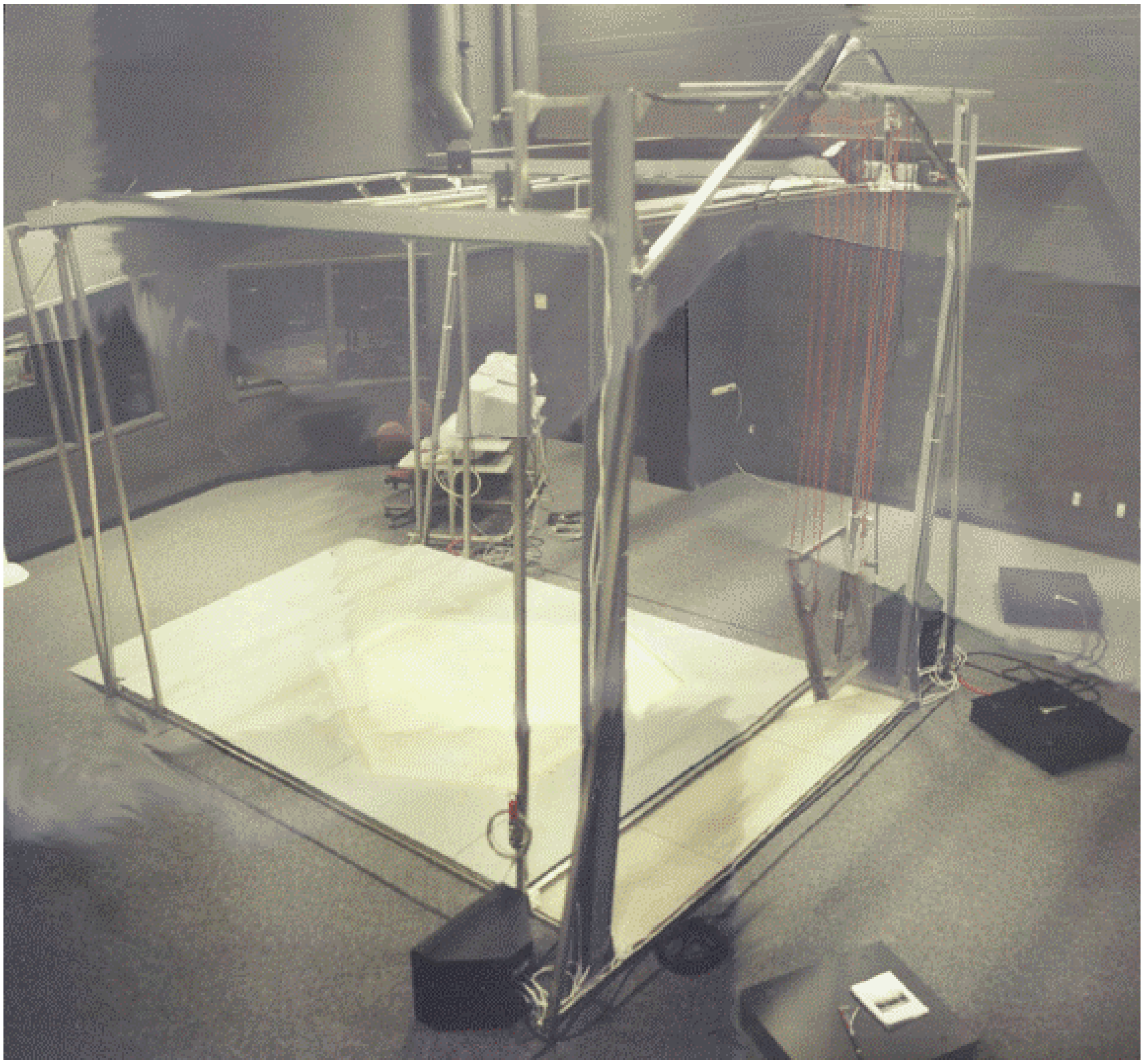

Figure 3. CAVE reconstruction with motion base embedded in CAVE floor, March 10, 2001.

Figure 4. CAVE floor substructure and motion base under construction, February 13, 2001.

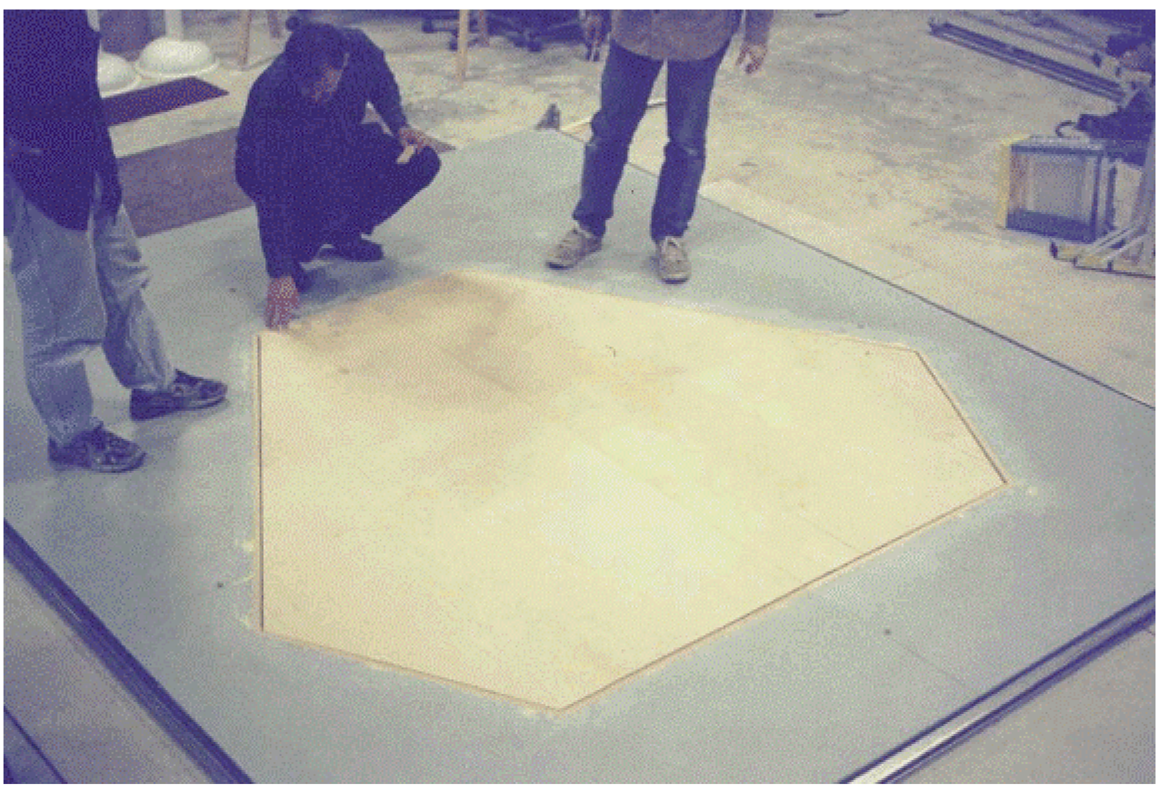

Figure 5. CAVE floor with motion base insert, March 1, 2001

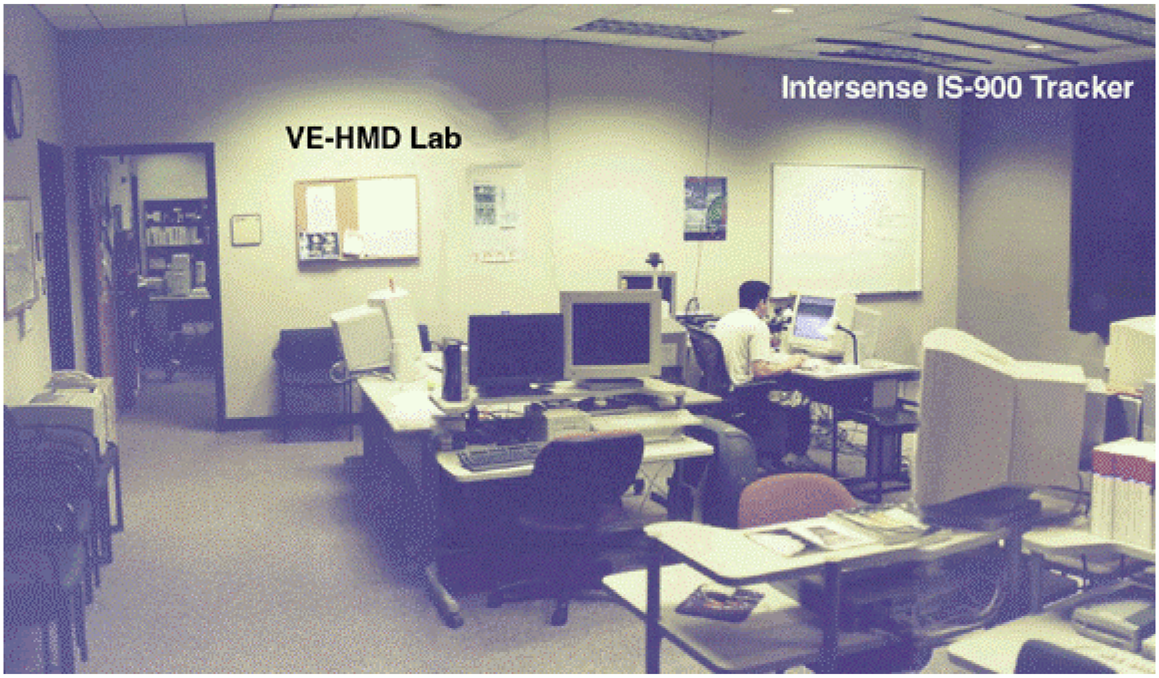

Figure 6. Virtual Environment HMD Lab and “dance floor”

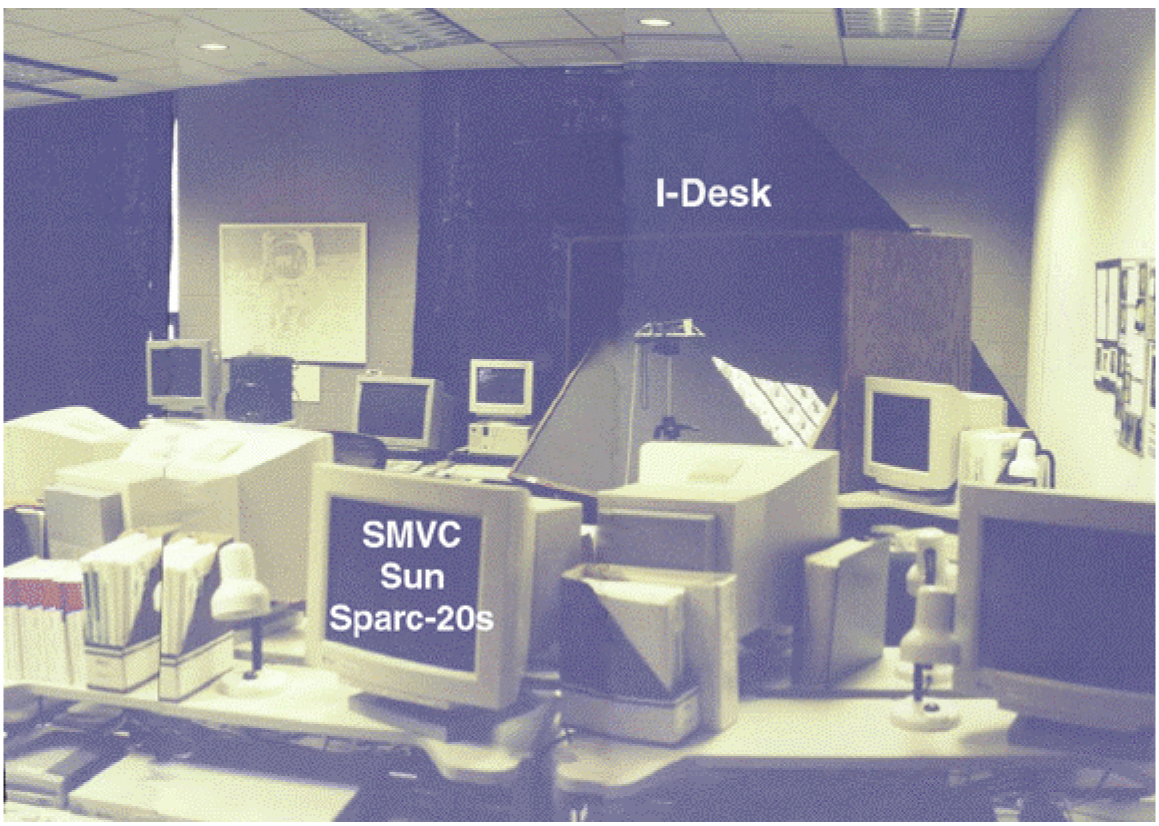

Figure 7. Scientific Modeling and Visualization Classroom and I-Desk, co-sponsored by Visual Numerics, Inc. and Sun Microsystems, Inc.

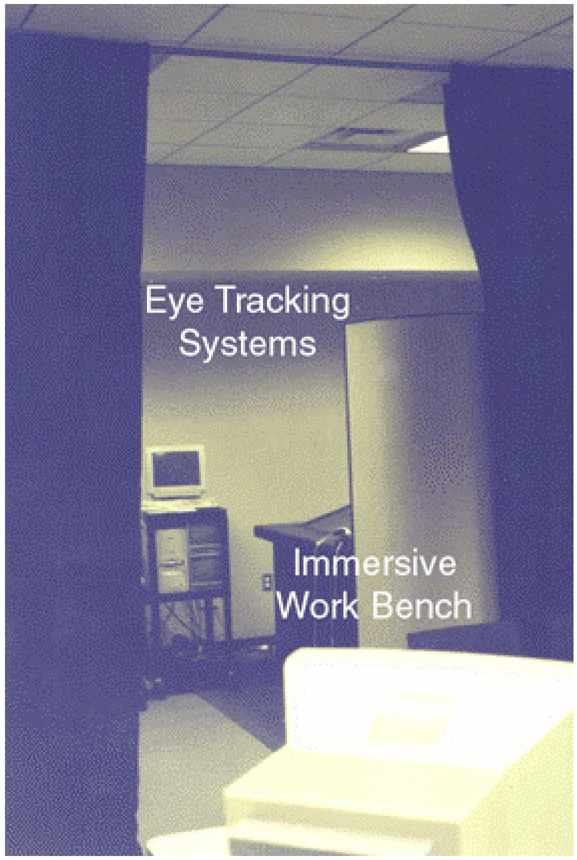

Figure 8. Immersive Work Bench and eye-tracking systems (HCI) viewed from VE-Lab.

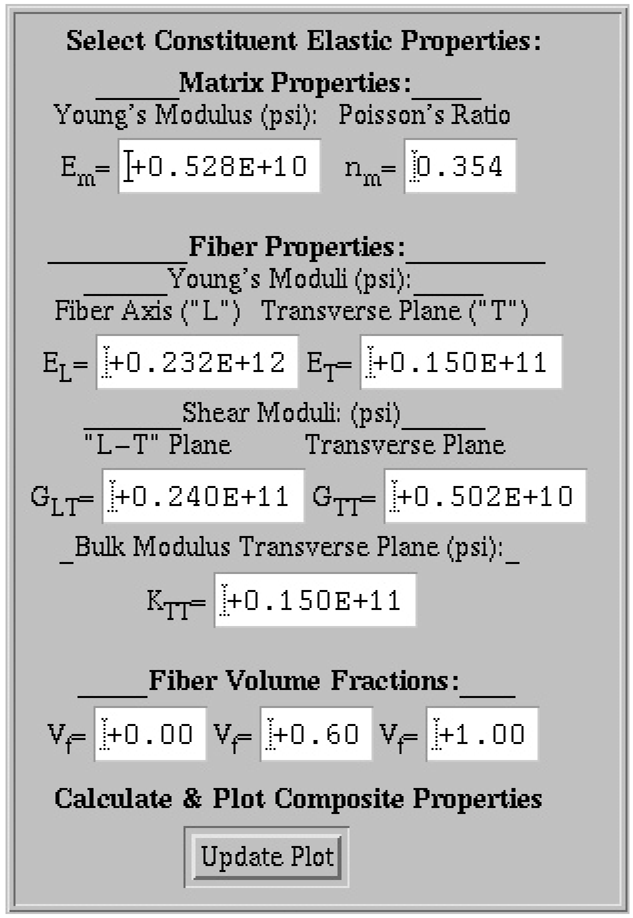

Figure 9(a). Module01 JWave-GUI: entry of micro-scale constituents (fiber/matrix) elastic properties.

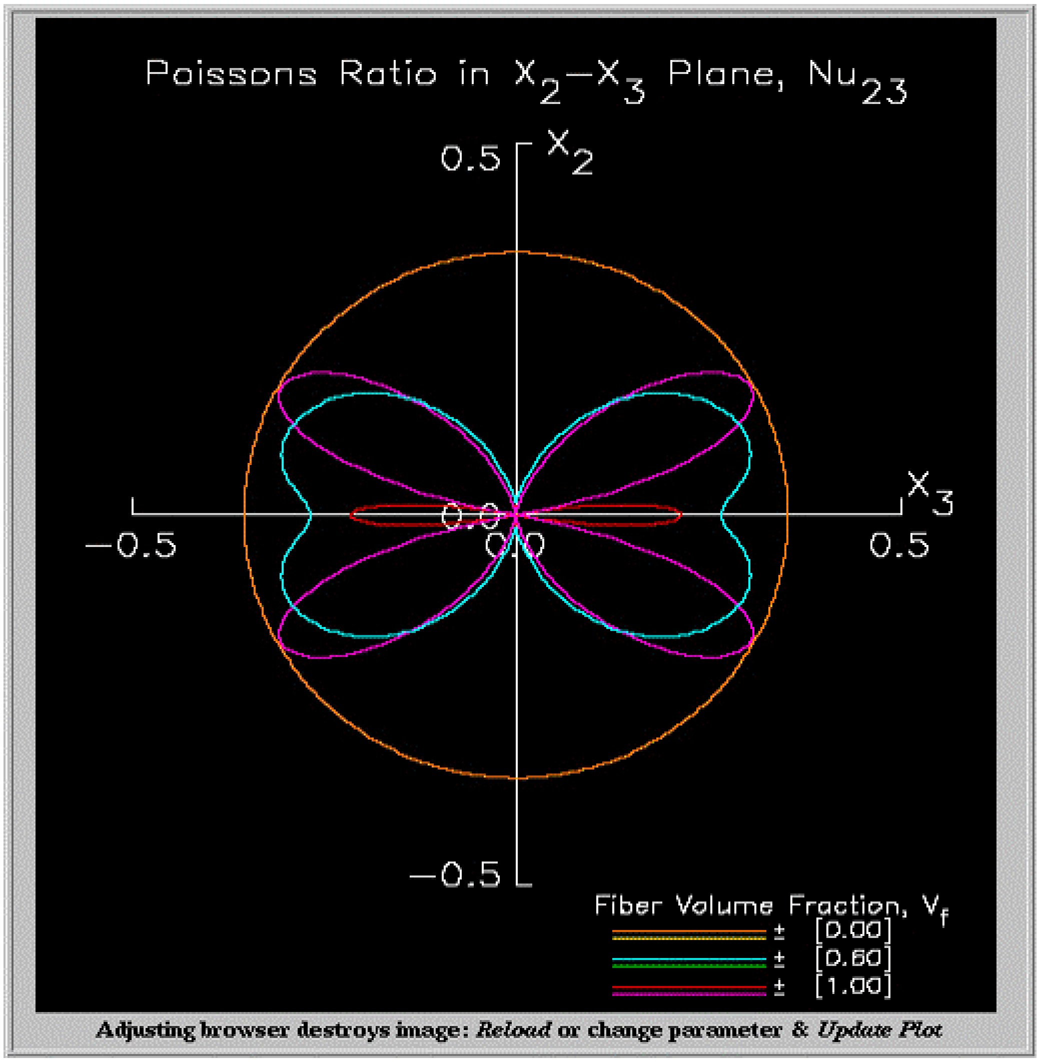

Figure 9(b). Module01 JWave-GUI: macro-scale elastic anisotropic polar plot of Poisson's ratio for a unidirectional fiber-reinforced composite material calculated from the micro-scale (fiber/matrix) properties shown in Figure 9(a).

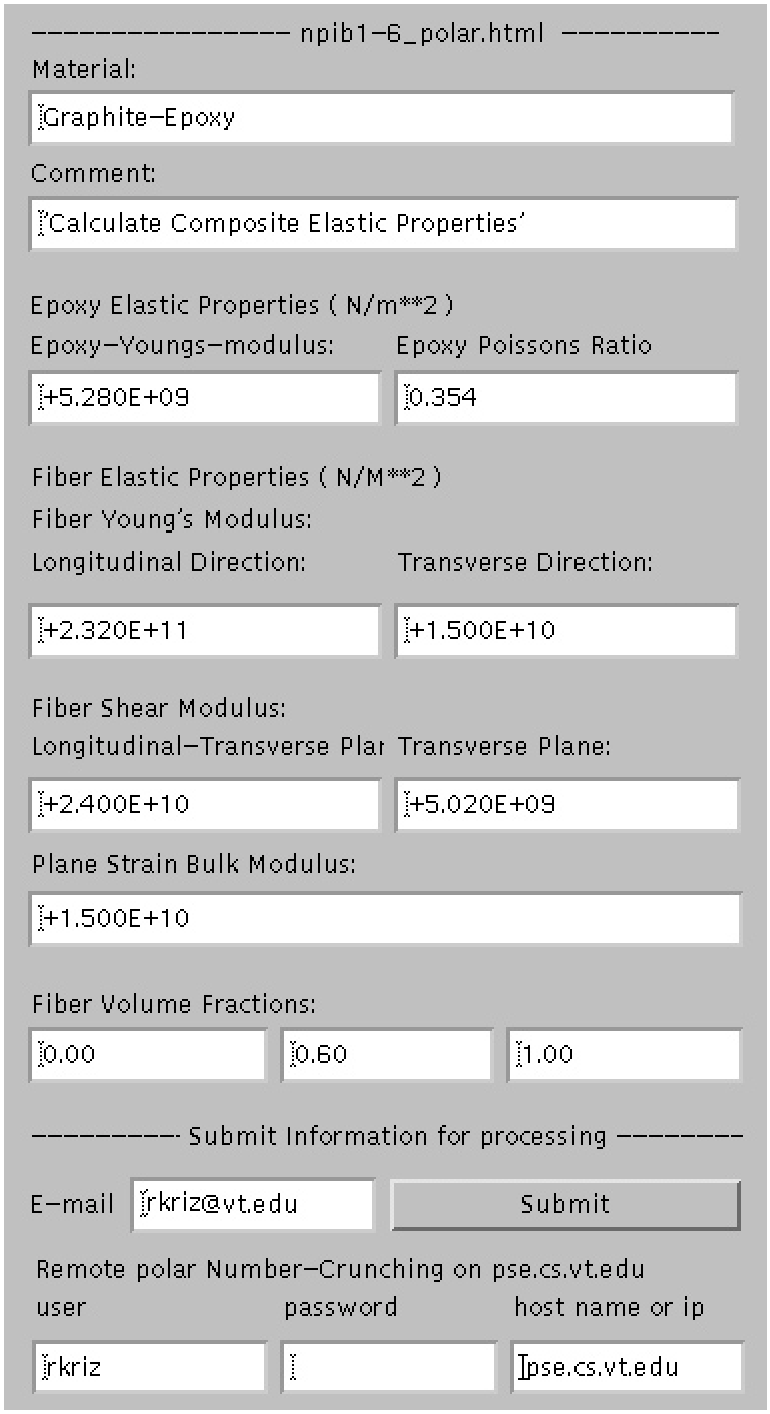

Figure 10. NPIB form as viewed on a client's Web browser, which is used to submit batch jobs to remote computers.

Figure 11. "Working" real-time archive of simulation results for calculating elastic property polar plots of a unidirectional fiber-reinforced composite. For comparison the same polar plot of Poisson's ratio shown in Figure 9(b) can be viewed by selecting nu32.jpg file in this directory.

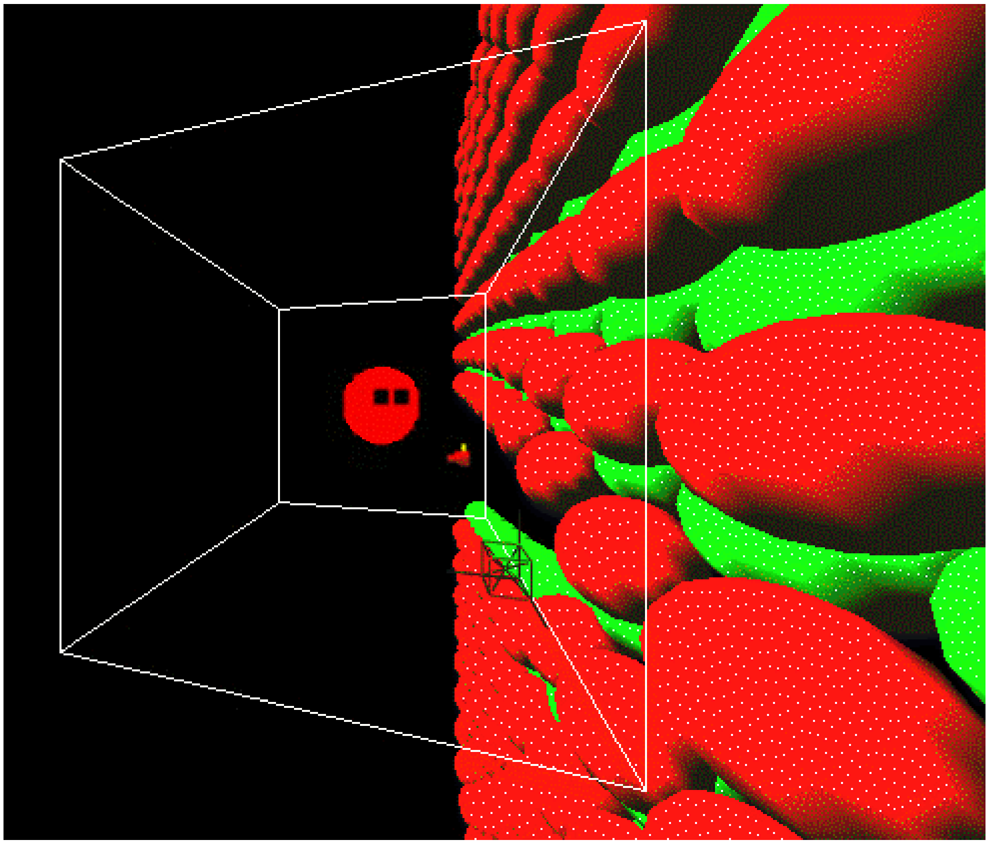

Figure 12. CAVE simulation view of a Mode-I crack propagation along Ni-Al grain boundary (nano-scale module01). White lines simulate the CAVE room boundaries. The head is simulated by a sphere near the center of the CAVE room with two black dots for eyes which can only simulate the fully immersive experience of being inside the CAVE.

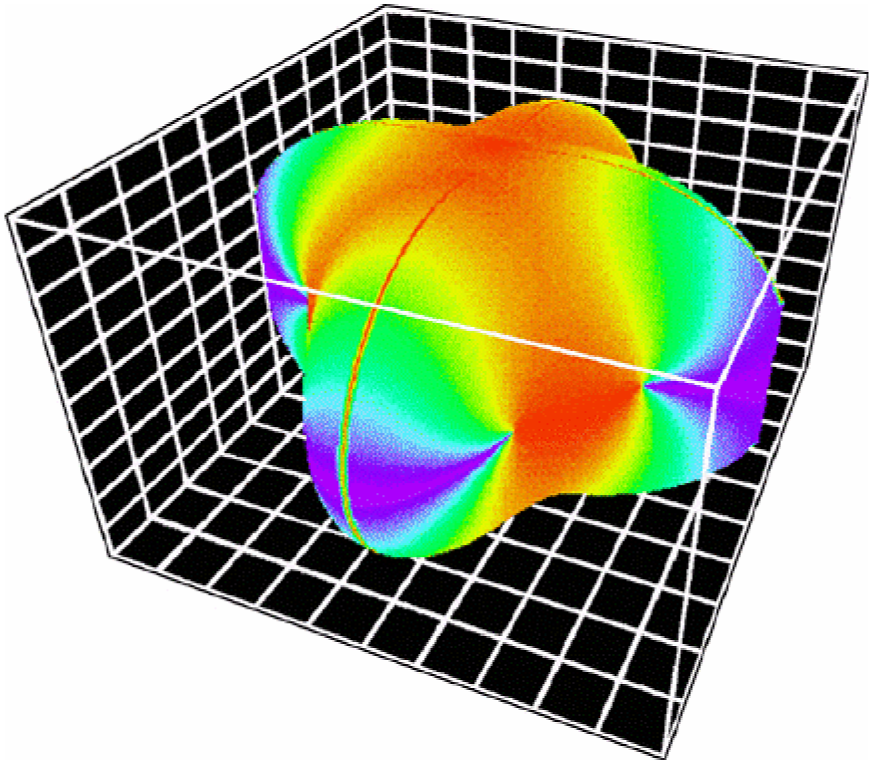

Figure 13. CAVE simulation view of a fourth-order stiffness tensor wave-surface glyph representation of a special crystal class symmetry for orthorhombic symmetry, where the longitudinal and both transverse wave surfaces are connected into a single surface (micro-scale module04). For simplicity only the intermediate transverse wave surface is shown. The fully connected wave surface, not shown here, requires a fully immersive CAVE environment. Glyph data format is VRML 1.0, WEB-SITES: [3].