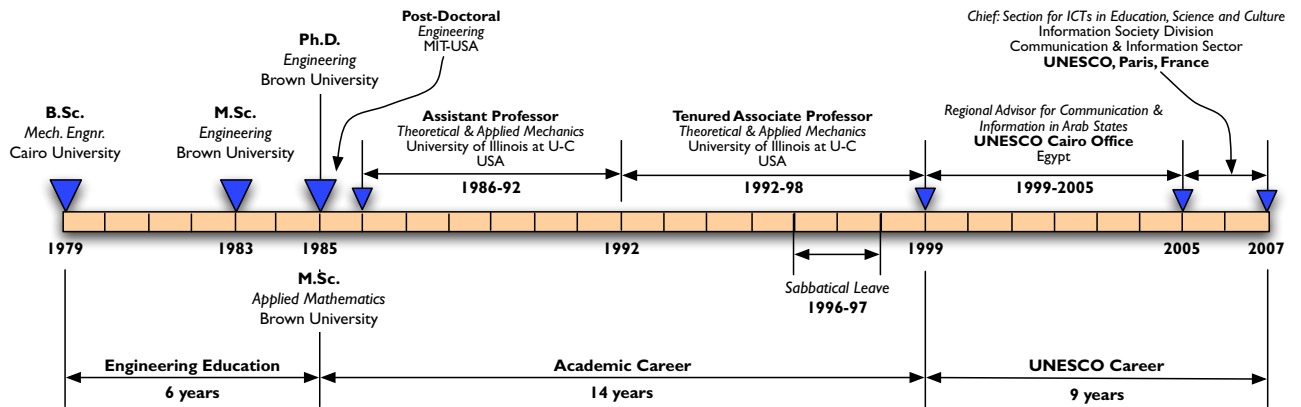




United Nations Educational, Scientific and Cultural Organization

Tarek Galal Shawki

Bibliography



For more information, please send inquiries to
t.shawki@unesco.org

Educational Background

Ph.D.	in Engineering, Brown University, Providence, RI	June 1985
M.Sc.	in Applied Mathematics, Brown University, Providence, RI	June 1985
M.Sc.	in Engineering, Brown University, Providence, RI	June 1983
B.Sc.	in Mechanical Engineering, Cairo University, Cairo, EGYPT	July 1979

Employment History

2005-Present	Chief of Section “ICTs in Education, Science and Culture” Information Society Division, Communication and Information Sector UNESCO, Paris, France
1999-2005	Regional Advisor for Communication & Information in Arab States UNESCO Cairo Office Cairo, Egypt
1997-1998	Executive Director of the Global Campus Regional Information Technology & Software Engineering Center (RITSEC) Cairo, Egypt (On Assignment from Illinois)
Jan 1998-2000	Emeritus Professor College of Information Technology & Decision Support Suez Canal University, Ismailia, Egypt
1992-1998	Associate Professor Department of Theoretical and Applied Mechanics University of Illinois at Urbana-Champaign, USA
1986-1992	Assistant Professor Department of Theoretical and Applied Mechanics University of Illinois at Urbana-Champaign, USA
1985-1986	Post-Doctoral Research Associate Massachusetts Institute of Technology Cambridge, MA, USA
1982-1985	Research Assistant Brown University, Providence, RI, USA
1981-1982	University Fellow Brown University, Providence, RI, USA

Areas of Professional Interest

Information & Communications Technology Applications in Education and Science, Computer-Aided Instruction, Applied Mechanics, Applied Mathematics, Dynamic Plasticity, Machine Design.

Major Professional Highlights (ICT Apps)

Architect of UNESCO's "ICT Competency Standards for Teachers"

A set of universal standards for teachers' competency levels regarding the use of ICTs in teaching. Such standards represent the foundation for the future teacher training and certification in the 21st century.

Architect and Manager of UNESCO's "ICT Capacity Building Project in Libya"

A massive national project for the reform of higher education in Libya. The project estimated cost is over \$72 Million US dollars for five years. It involves networking infrastructure, e-classrooms, faculty and student laboratories, backoffice applications, content management, educational broadcasting and staff training.

Architect of the vision on "Building Knowledge Societies"

Crafted the global vision for building knowledge societies with a special emphasis on knowledge transfer models.

Architect of the "UNESCO-Microsoft Global Cooperation Agreement"

A global agreement signed by UNESCO's Director-General and Mr. Gates on November 17, 2004.

Architect and Manager of UNESCO's "ICT Knowledge Park Project in Bahrain"

A novel undertaking involving the establishment of an "ICT in Education" knowledge park in the Kingdom of Bahrain. Estimated cost is \$20 Million US dollars (excluding buildings).

Manager of the "UNESCO partnerships with Microsoft, Intel, Cisco, and Apple"

An array of powerful partnerships with the leading IT industries to pass benefits to UNESCO's member states.

Launch of the "UNESCO-Microsoft Innovative Teachers Network - Arabia"

A novel programme to empower teachers using a portal for online collaboration and sharing of best practices, digital educational content, annual teachers forums and an annual award for the best innovative teachers in the Arab world.

Major Professional Highlights (ICT Apps) - Continued

Deployment of an Open-Source CMS in the AOU E-Learning Model

The excellent FOSS package “Moodle” was successfully deployed in many branches of the “Arab Open University” to offer online Arabic courses.

The Syrian Higher Education and Research Network (SHERN)

This is a 5 year project (1999-2004) which connected all higher education institutions in Syria. The project has already helped Syria launch its first “Virtual University”.

ICT Applications in Bibliotheca Alexandrina

Complete IT infrastructure design for the bibliotheca Alexandrina,
Section for the visually-impaired in the Bibliotheca,
Establishment of the IT unit within the Bibliotheca and hiring its staff,
Establishment of the “Manuscript Museum”,
Establishment of the “Manuscript Restoration Laboratory”,
Developed the BA DVD documentary.
Established the first “State-of-the-art” Scientific Visualization facility (the Cave), and
Supporting BA to host the first Arab “Super Computer”.

Architect of UNESCO Initiatives on

“Content-to-Go”: Using PDA’s and Ipods to deliver digital educational content,
“Podcasting for Development”: Using the new “podcasting” technology in rural areas,
“Supercomputing”: Using desktop computers to build cheap grid computing solutions,
“FOSSpedia”: A series of DVDs containing compiled packages of open-source software,

A Framework for the Arabization of Internet Domain Names

A project by UNESCO and the League of Arab States to help develop the necessary framework (political and technical) towards the Arabization of IDNs.

A Framework for the Memory of the Arab World

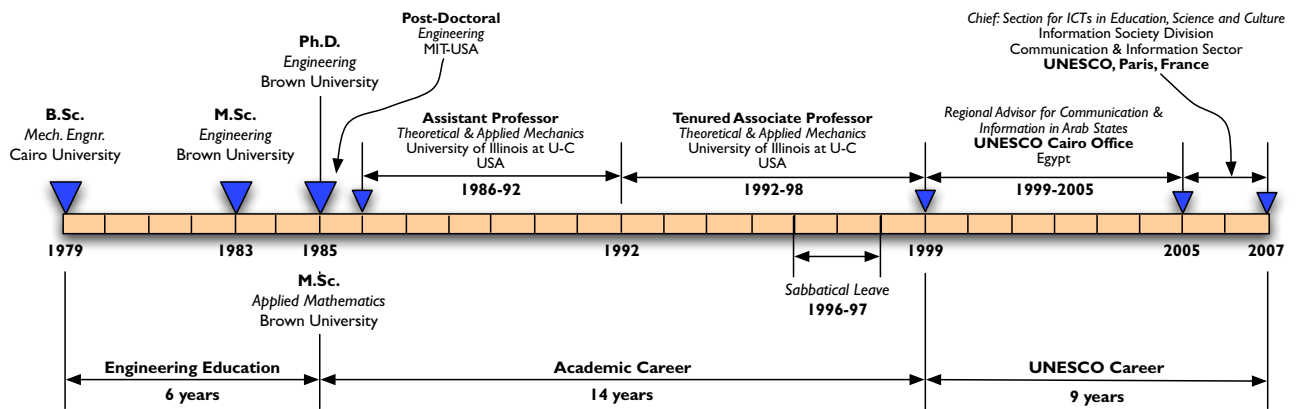
A project by UNESCO to preserve Arab and Islamic heritage with a particular emphasis on manuscripts dealing with mathematics and science.

A Sub-Regional ICT Resource Center for Youth in North Africa

Launched on November 17 of 2005, this center provides a spectrum of services to the youth in North African Arab States.

Honors and Awards

Presidential Young Investigator Award - National Science Foundation	(1989–1994)
Associate Editor, International Journal of Applied Inelasticity,	(1992)
Member of the advisory committee National Science Foundation <i>Institute of Mechanics and Materials</i>	(1992–1996)
Co-editorial assignment of the special issue on <i>“Material Instabilities” ASME-Applied Mechanics Reviews</i>	(1991)
Panelist for the National Science Foundation (NSF) <i>Solid Mechanics and Materials program</i>	(1991)
Panelist for the National Research Council (NRC)	(1989)
Advisors List Award - University of Illinois	(1989)
Recipient of the Initiation Grant, National Science Foundation,	(1987–1989)
List of Excellent Teachers at the University of Illinois,	(1986–1993)
Most outstanding student, Cairo University,	(1974–1979)



Scientific Research Funding (1987-1998)

NATIONAL SCIENCE FOUNDATION 1995–1998 Research Award, Amount: \$420,000.	Virginia, USA
UNIVERSITY OF ILLINOIS 1995–1996 Learning Technologies Award, Amount: \$23,500.	Illinois, USA
THE ANDERSON FOUNDATION 1995–1996 Learning Technologies Gift, Amount: \$10,000.	Connecticut, USA
NATIONAL SCIENCE FOUNDATION 1989–1994 Presidential Young Investigator Award, Amount: \$500,000.	Washington, USA
THE DOW CHEMICAL COMPANY 1992–1994 Research Grant, Amount: \$60,000.	Midland, MI, USA
NATIONAL SCIENCE FOUNDATION 1987–1989 Initiation Grant, Amount: \$60,000.	Washington, DC, USA
UNIVERSITY OF ILLINOIS - EDUCATIONAL TECHNOLOGY BOARD 1991 Teaching Innovation Grant, Award: \$17,000 for equipment purchases.	Urbana, IL, USA
UNIVERSITY OF ILLINOIS - RESEARCH BOARD 1987 Research initiation, Amount: \$11,000.	Urbana, IL, USA

Teaching of Engineering and Mathematics

□ Graduate Courses

- ▷ Applied Mathematics: Part I (*Ordinary Differential Equations*)
- ▷ Applied Mathematics: Part II (*Partial Differential Equations*)
- ▷ Fracture Mechanics
- ▷ Theory of Elasticity

- ▷ Theory of Plasticity
- ▷ Advanced Numerical Methods (*Finite Difference Methods*)

□ **Undergraduate Courses**

- ▷ Introduction to Computational Mechanics
- ▷ Elementary Mechanics of Solids
- ▷ Behavior of Engineering Materials (Metals, Ceramics and Composites).
- ▷ Machine Design
- ▷ Engineering Drawing

□ **General Topics**

- ▷ Technical Publishing on the World-Wide Web
- ▷ Modern Tools & Methods of Symbolic Computing

Thesis Direction - Engineering

R.A. SHERIF, PH.D.
1989

IBM, Fishkill, NY, USA

Thesis: “*The Mechanics of Shear Band Formation in Thermal Viscoplastic Materials at High Rates of Loading*”.

H. WANG, SC.M.
1990

University of Illinois, USA

Thesis: “*On The Derivation of a Localization Damage Parameter For Viscoplastic Materials*”.

A. ACHARYA, PH.D.
1994

University of Pennsylvania, PA, USA

Thesis: “*A Continuum Mechanics Approach to Material Instability Analyses*”.

H.P. CHERUKURI, PH.D.
1995

University of North Carolina, NC, USA

Thesis: “*Energy-Based Criteria for the Characterization of Shear Localization in Dynamic Viscoplasticity*”.

A. TAHA, PH.D.
current

University of Illinois, IL, USA

Thesis: “*Localization Toughness and Material Failure at High Loading Rates*”.

Publications - Engineering

- H.P. Cherukuri and T.G. Shawki (1997), “*On Shear Band Nucleation and the Finite Propagation Speed of Thermal Disturbances*”, the Int. J. Solids & Structures, Vol. 34, No. 4, pp. 345–450.
- H.P. Cherukuri and T.G. Shawki (1996), “*A Finite-Difference Scheme for Elastic Wave Propagation in a Circular Disk*”, the J. Acoust. Soc. Am., Vol. 100, No. 4, pp. 2139–2155.
- A. Acharya and T.G. Shawki (1996), “*The Clausius-Duhem Inequality and the Structure of Rate-Independent Plasticity*”, Int. J. of Plasticity, Vol. 12, No. 2, pp. 229–238.
- A. Acharya and T.G. Shawki (1995), “*Thermodynamic Restrictions on Constitutive Equations for Second-Deformation-Gradient Inelastic Behavior*”, J. Mech. Phys. Solids, Vol. 43, No. 11, pp. 1751.
- T.G. Shawki (1995), “*On Shear Flow Localization with Traction-Controlled Boundaries*”, the International Journal of Solids & Structures, A special volume in memory of the late Professor J. Duffy, Vol. 32, No. 17/18, pp. 2751.
- H.P. Cherukuri and T.G. Shawki (1995a), “*An Energy-Based Localization Theory, Part I: Basic Framework*”, the Int. J. of Plasticity, Vol 11, No. 1, pp. 15.
- H.P. Cherukuri and T.G. Shawki (1995b), “*An Energy-Based Localization Theory, Part II: Effects of Inertia, Dissipation and Diffusion Numbers*”, the Int. J. of Plasticity, Vol 11, No. 1, pp. 41.
- T.G. Shawki (1994a), “*An Energy Criterion For The Onset of Shear Localization in Thermal Viscoplastic Materials, Part I: Necessary and Sufficient Initiation Conditions*”, the ASME J. of Applied Mechanics, Vol. 61, No. 3, pp. 530.
- T.G. Shawki (1994b), “*An Energy Criterion For The Onset of Shear Localization in Thermal Viscoplastic Materials, Part II: Applications and Implications*”, the ASME J. of Applied Mechanics, Vol. 61, No. 3, pp. 538.
- R.A. Sherif and T.G. Shawki (1992), “*The Role of Heat Conduction During the Post-Localization Regime in Dynamic Viscoplasticity*”, ASME-Applied Mechanics Summer Meeting.
- T.G. Shawki (1992), “*The Phenomenon of Shear Strain Localization in Dynamic Viscoplasticity*”, A review article, ASME-Applied Mechanics Reviews, Vol. 45, No. 3, Part 2, pp. S46-S61.
- T.G. Shawki, R.A. Sherif and H.P. Cherukuri (1992), “*Characterization of Severe Localization in Dynamic Viscoplasticity*”, ASME-Applied Mechanics Reviews, Vol. 45, No. 3, Part 2, pp. S149-S153.
- T.G. Shawki and R.J. Clifton (1989), “*Shear Band Formation In Thermal Viscoplastic Materials*”, Mechanics of Materials, Vol. 8, No. 1, pp. 13-44.
- T.G. Shawki, T. Nakamura, D.M. Parks (1989), “*Line-Spring Analysis of Surface Flawed Plates and Shells Using Deformation Theory*”, International Journal of Fracture, Vol. 41.

T.G. Shawki (1988), “*Analysis of Shear Instability in Viscoplastic Solids*, appeared in the refereed Proceedings of the 4th Cairo University Conference on Machine Design and Production, Cairo, Pergamon Press.

T. Nakamura, T.G. Shawki (1987), “*Accuracy of Deep-Crack Solutions in Fully-Plastic Edge Crack Panel Problems*, International Journal of Fracture, 35, R15 - R21.

L. Anand, K.H. Kim, T.G. Shawki (1987), “*Onset of Shear Localization in Viscoplastic Solids*, Journal of The Mechanics and Physics of Solids, Vol 35, No. 4, pp. 407-429.

S.L. Semiatin, J.J. Jonas, T.G. Shawki, J. Duffy (1987), “*Effect of Material Imperfections On Flow Localization in Torsion*, Scripta Metallurgica, Vol. 18, pp. 669 - 674.

R.W. Klopp, R.J. Clifton, T.G. Shawki (1985), “*Pressure-Shear Impact and The Dynamic Viscoplastic Response of Metals*, Mechanics of Materials, 4, pp. 375-385.

R.J. Clifton, J. Duffy, K.A. Hartley, T.G. Shawki (1984), “*On Critical Conditions For Shear Band Formation At High Strain Rates*, Scripta Metallurgica, Vol. 18, pp. 443 - 448.

Video Visualizations

T.G. Shawki, H.P. Cherukuri and F.M. Ahmad (1993), “*A Massive Parallel Computation of Shear Flow Localization in Dynamic Viscoplasticity*, A Video Visualization conducted at the National Center for Supercomputing Applications (NCSA), Champaign, Illinois.

H.P. Cherukuri, T.G. Shawki, and F.M. Ahmad (1993), “*Visualization of Stress Wave Propagation in an Axisymmetric Ceramic Disc due to Normal High Velocity Impact*, A Video Visualization conducted at the National Center for Supercomputing Applications (NCSA), Champaign, Illinois.

Books/Lecture-Notes

T.G. SHAWKI (1991, 1994), “*The Mathematical Theory of Fracture-An Introduction*, 182 pages, Printed by the Department of Theoretical & Applied Mechanics, University of Illinois.

T.G. SHAWKI (1990), “*Mathematical Methods For Engineers and Physicists, Part II - Partial Differential Equations*, 260 pages, Printed by the Department of Theoretical & Applied Mechanics, University of Illinois.

T.G. SHAWKI (1989,92), “*Introduction to the Behavior of Engineering Materials*, 200 pages, Printed by the Department of Theoretical & Applied Mechanics, University of Illinois.

T.G. SHAWKI (1989), “*Finite Difference Techniques For The Solution of Time-Dependent Systems of Partial Differential Eqns. - Theory and Applications*, 470 pages.

T.G. SHAWKI (1988), “*Mathematical Methods For Engineers and Physicists, Part I - Ordinary Differential Equations*”, T & AM Technical Report No. 486, 417 pages.

Web Sites - My Courseware

Note: The referenced sites existed in the middle and late nineties. You can still see them by visiting the Internet Archive at: <http://archive.bibalex.org> and searching for the respective web addresses provided below.

T.G. SHAWKI (Spring 1997), “*Modernizing Basic and Engineering Sciences Education Through Computational and Networking Technologies*”,
<http://e2.tam.uiuc.edu/workshop/>.

This web-based course was delivered - in person - to faculty members in various contries across the Middle East region .

T.G. SHAWKI (Fall 1996), “**TAM 485 - Fracture Mechanics**”,
<http://e2.tam.uiuc.edu/Fracture/>.

This web-based course was delivered from Cairo (Egypt) to students at Illinois.

T.G. SHAWKI (Spring 1996), “**TAM 452 - Theory of Elasticity - Part II**”,
<http://e2.tam.uiuc.edu/TAM452/>.

T.G. SHAWKI (Fall 1995), “**TAM 441 - Applied Mathematics - Part I**”,
<http://e2.tam.uiuc.edu/TAM441/>.

T.G. SHAWKI (Fall 1995), “**TAM 370 - Introduction to Computational Mechanics**”,
<http://e2.tam.uiuc.edu/TAM370/>.

T.G. SHAWKI (Spring 1995), “**TAM 221 - Strength of Materials**”,
<http://e2.tam.uiuc.edu/TAM221/index/>.

Administrative Experience (Academic Career)

Chair of the College of Engineering committee on Teaching Evaluation and Improvement, (1990–92).

Senator of the Department of Theoretical & Applied Mechanics to the University of Illinois Senate, (1990–92).

Member of the elected departmental advisory committee for four terms (1988–90,92,93,94). Chair of the committee since (1993).

Chair of the departmental computing and networking committee, (1991–current).

ADMINISTRATIVE EXPERIENCE (ACADEMIC CAREER)

Member of the departmental graduate curriculum committee, (1991–92).

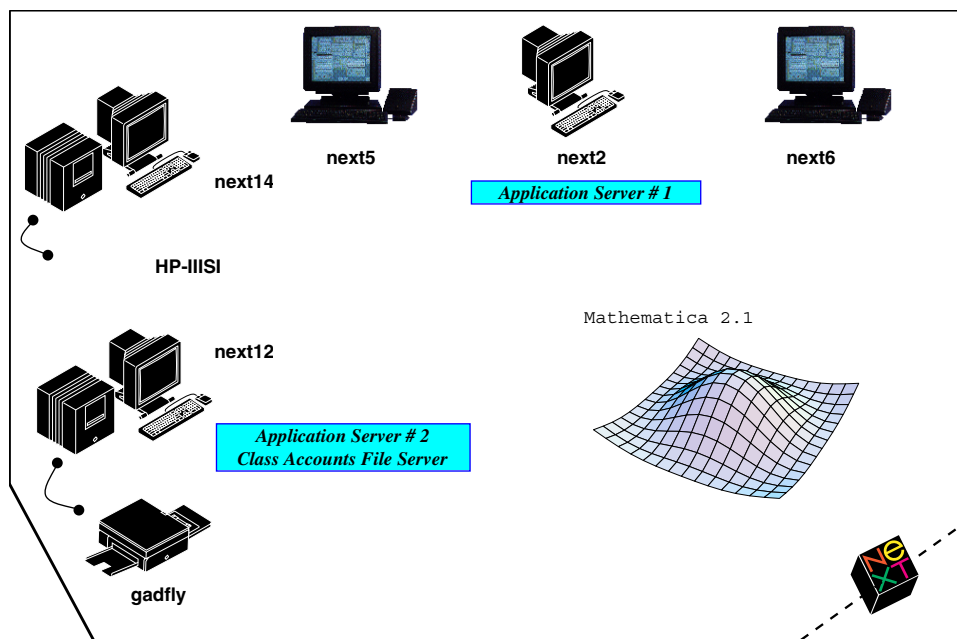
Member of the departmental Mechanics Advisers committee, (1990–92).

Member of the Senate committee on Academic Freedom and Tenure, (1992).

Member of the College committee on Strategic Planning for Computers and Networking, (1993-96).

High Performance Computing (1990-98)

Since the early nineties, my research and teaching programs have utilized the extensive computing resources at the University of Illinois. Furthermore, I have used the PYI matching funds to build a modern computational facilities which includes a mixture of IBM microcomputers, HP-Unix workstations and a complete laboratory of NeXT workstations. The diagram below illustrates, schematically, the organization of the NeXT laboratory.



Scientific Research: Our recent research activities involve massive computations aiming at exploring the structure of evolving shear bands and the connection between shear localization and structural failure. Such computations require the development of robust numerical schemes that are capable of resolving the complete localization history. A typical computation of complete shear band evolution in a structural steel requires few million time integration steps. Current desktop workstations allow such computations to be performed in 10 to 15 CPU hours. Furthermore, we have used distributed computing on our various NeXT workstations (which run in parallel) to accelerate the overall computation time. In another development, we have ported our finite difference code to both the CRAY YMP (the University of Illinois super computer) as well as to the CM-5 (the University of Illinois Parallel super computer). This development illustrated the performance gains achieved through parallel computing in problems where spatial resolution is of major concern.

Teaching: The aforementioned computer laboratories have also been used to introduce computational mechanics to class room teaching. I have recently introduced symbolic and numerical

computing to my graduate courses. This involved using the Mathematica software during in-class instruction and providing access to the workstation laboratories.

RESEARCH PROGRAM (1986-1996)

The broad topic of FAILURE OF ENGINEERING MATERIALS SUBJECT TO ULTRA-HIGH LOADING RATES has been the focus of my research efforts during the past decade. This research program was initiated during the summer of 1981 upon my association with Professor Rodney J. Clifton at Brown University. The state-of-the-art, at that time, was rather limited. The phenomenon of shear flow localization during high rate deformations of solids was identified as a major thrust in applied mechanics. The name “shear flow localization” refers to the evolution of an inhomogeneous deformation field from an otherwise homogeneous background field. The resulting inhomogeneous field is primarily characterized by the concentration of large plastic strains within narrow spatial bands often separated by some characteristic spacing. Such spatial regions of intense local plastic flow are commonly referred to as *shear bands*. An extensive literature of experimental findings indicates that this phenomenon is observed in a wide spectrum of materials (ferrous, non-ferrous and polymeric glasses), loading rates (quasi-static to dynamic), applications (high-speed machining, ballistic impact, metal forming, hot forging, high velocity punching, etc.) and observation length scales (single crystal level to the macroscopic scale). This large spectrum of observations explains the complexity of the phenomenon as well as the equally large number of mechanisms suggested for its analysis.

Depending on the utilization of two major factors, most analyses of shear band formation can be cited as belonging to one of the four categories illustrated in the table shown below. The focus of my research program resides in the category identified by the rate-dependent material response subject to dynamic deformation conditions.

	RATE-INDEPENDENT	RATE-DEPENDENT
QUASI-STATIC	<i>Loss of Ellipticity</i>	<i>Unbounded Solutions</i>
DYNAMIC	<i>Loss of Hyperbolicity</i>	<i>Energy Criterion</i>

Apart from the scientific interest in the phenomenon of shear flow localization, it draws its technical importance from the fact that it is often a precursor to catastrophic structural failure. Unlike other similar failure-inducing phenomena (e.g. fracture, fatigue, creep, etc.), the understanding of the phenomenon of shear band formation was, in the early eighties, at its infancy. Only three journal articles addressing this phenomenon were available in 1981. A decade later, this number is nearly a 120 articles in engineering journals. Here, I will attempt to position my research program within this extensive activity as well as attempting to illustrate its direction and expected impact. The flow chart at the end of this statement may serve to illustrate the major stages of my research program during the past decade as well as the proposed plan for the next five years.

My research efforts beginning in the past five years (1990-1995) have been primarily directed to the improved understanding of fundamental aspects of shear band formation. A schematic illustration of these efforts is provided in Figure (1).

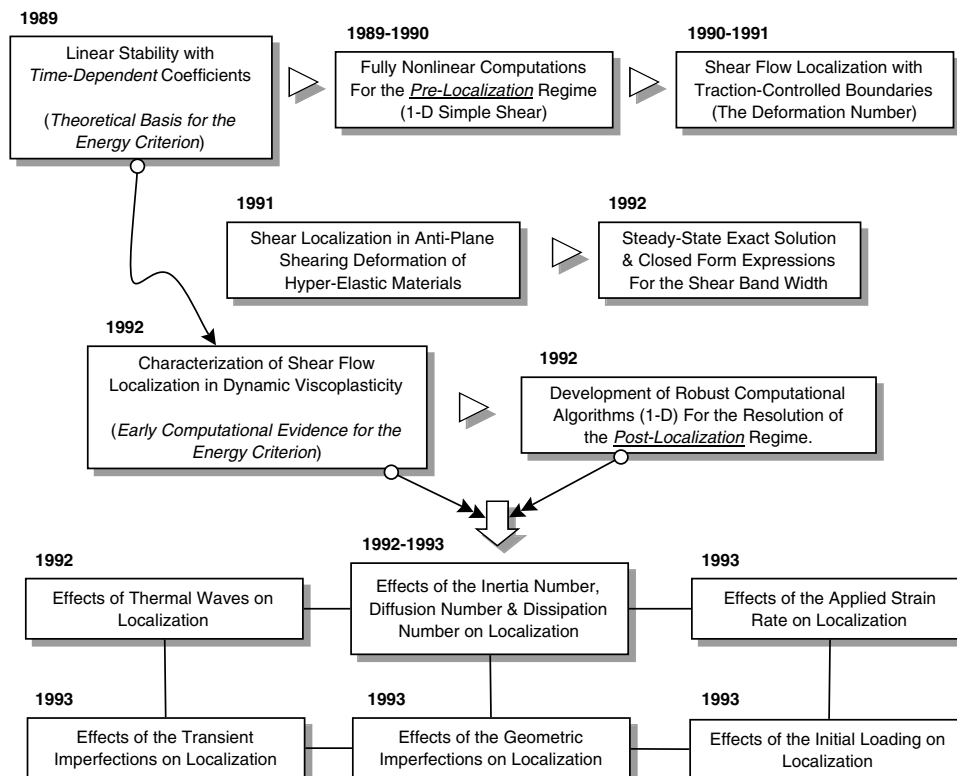


Figure (1) - Prior Research Progress (Localization only) - PI: T.G. Shawki

Typical fundamental issues in my research program include:

- Effect of material properties (e.g. strain hardening, thermal softening and strain rate sensitivity, heat conduction and non-local effects) on the onset and subsequent propagation of shear bands.
- Effect of boundary conditions, initial geometric and/or material imperfections on the phenomenon.
- Mathematical modeling and in particular the interactive roles of inertia and material rate sensitivity on the well-posedness of the mathematical model.
- Macroscopic as well as microscopic mechanisms for a possible explanation of the formation of localized deformation zones (e.g. the thermo-mechanical mechanism and the geometric softening mechanism).
- Effect of loading rates on the formation of localized deformations.
- The constitutive description of material response over rather wide spectrums of strains, strain rates and temperatures.

- The development of accurate, consistent, stable and efficient computational algorithms that are capable of resolving the large spatial gradients and fast evolution rates associated with this phenomenon.
- Experimental testing aiming at resolving both macroscopic and microscopic questions related to shear localization and its connection to material failure.

Figure (2) illustrates my vision of the future direction in which we put our developed theory into practice. Drawing on the analogy with Fracture Mechanics, we seek a material-dependent critical value of the localization parameter which is to be termed the LOCALIZATION TOUGHNESS (analogous to “fracture toughness”). At this stage, one should develop standards for experimental evaluation and proceed with an extensive experimental research program aiming at the inclusion of the new material property in engineering handbooks.

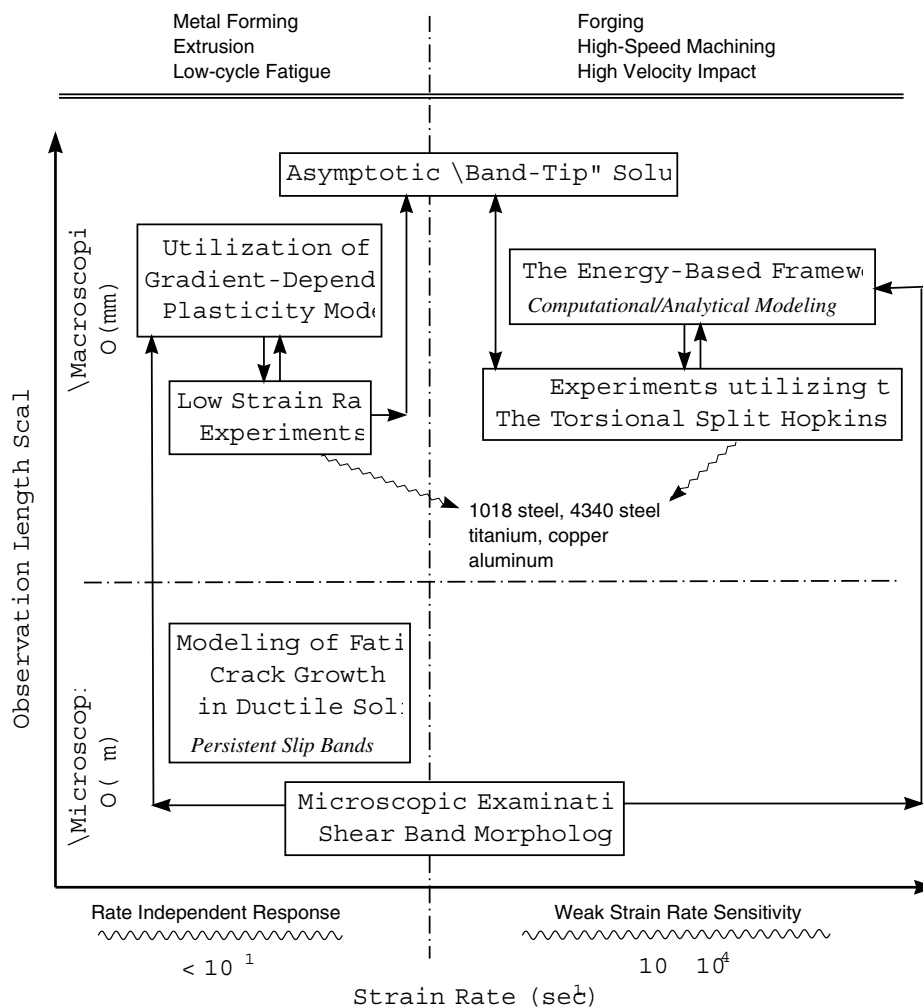


Figure (2) - My current research program

Aside from research activities pertaining to shear localization, I have had contributions to constitu-

tive modeling at high rates and the development of the so-called line-spring model for the analysis of surface cracks in plates and shells.

The general goal of my former and ongoing research activities has been to provide a consistent, rigorous and sufficiently general framework for the analysis of material failure in a wide range of materials and loading conditions. My guideline for the assessment of the program success is primarily related to its usefulness towards designing new materials which can safely operate under severe conditions. Furthermore, It seems that I utilize a mixed background of mechanical engineering (specifically, machine design and production engineering) with an applied mathematics/continuum mechanics graduate training towards the treatment of research problems. Early stages of my research program have benefited from the analytical training and style of my graduate years whereas current and future efforts appear to be primarily driven by my interest in putting the theory to practice.

Teaching Accomplishments (1986-1998)

Philosophy

This document contains some of my personal views and philosophy regarding teaching. First, it is my strong belief that teaching is an integral part of an academic institution's mission along with scientific research. Furthermore, it seems to me that the impact of these two activities is quite different. In most cases, teaching provides students with information for the first time while research targets an audience that is, for the most part, mature and well-informed about the subject area. Therefore, it appears to me that while excellent teaching and research are unquestionably positive attributes; poor teaching may have a severe adverse impact on students as opposed to the milder impact of poor research on the academic and scientific communities. In mathematical terms, the domain of influence of teaching is larger than that associated with research. Moreover, teaching prepares generations for both practice and research. Hence, it appears that excellent teaching is a necessary condition for excellent research whereas poor teaching is a sufficient condition for poor research and/or practice of a given discipline.

In fact, I am constantly fascinated by issues related to implementation, impact and evaluation of teaching activities. I have had a chance to teach undergraduate students, graduate students and continuing education students. It is interesting to observe that difficulties in learning, across a wide spectrum of ages and backgrounds, can be traced back to very early poor introductions to the subject area. In view of the foregoing observations, I do feel a tremendous responsibility towards teaching. This may explain the relatively-large proportion of time that I reserve for my teaching duties at the University of Illinois. Such duties have involved the re-construction of a number of core courses in the Department of Theoretical and Applied Mechanics. These include: (i) two graduate-level, applied mathematics courses, (ii) a graduate-level, numerical methods course, (iii) a graduate-level, fracture mechanics course and (iv) the undergraduate, cross-listed, course on the behavior of engineering materials. For each one of the above courses, I have attempted to design a syllabus that is: (1) self-contained, (2) systematic, (3) sufficiently rigorous and (4) modern. Furthermore, I have always attempted to provide the students with an overview of the course topic and how it fits with the material in other courses and disciplines. For the above reasons, it appears necessary, in my view, to prepare detailed lecture notes that reflect the objectives cited earlier. Colleagues and graduate as well as undergraduate students expressed great interest in having such lecture notes, which encouraged me, each time, to bring them to completion. These lecture notes are written specifically for interested students of contrasting backgrounds who are being first introduced to the topic. Although the contents of these notes may be found in many excellent textbooks, the notes provide a wide collection of topics (which may not be found in any one textbook) with a serious effort to provide the student with the needed background, whenever necessary, to overcome the difficulty of having students from various engineering departments enrolled in the same course. Moreover, the process of writing these lecture notes offers me a chance to re-examine the topic of the course and study the new developments in the field. In fact, in writing the lecture notes on Fracture Mechanics, I read more books and journal articles than in all of my graduate years. This

teaching-related effort has resulted in a number of ideas to be pursued in my research program.

On another front, I served as the chair of the college teaching evaluation and improvement sub-committee last year and was re-appointed as the chair for an additional year. This appointment is of great interest to me since I can discuss views concerning teaching with colleagues across the college while having an opportunity to encourage excellent teaching.

I have been also involved in continuing engineering education through the video taping of my graduate numerical methods course as well as the live teaching of a graduate applied mathematics course this semester in the Chicago area. Here, it was necessary to tailor the course material to the objectives of an audience of industrial nature. However demanding, this activity has been a learning experience for me as far as knowing "What do we need to teach our students to help them be competitive in the market place?".

Of equal importance is the teaching activity related to thesis advising. My general objectives in this area include: (i) the student acquires a diverse academic background that is not limited to his/her research topic, (ii) the student performs original research in the subject area, (iii) the student is exposed to the research community on campus and in conferences and workshops and (iv) the student learns about the process of writing proposals and journal articles. In fact, I often tell my research students that a crucial aspect of successful research work is to ask the right question. In order to accomplish this, one has to be aware of other efforts in the research area to maintain an updated overview of the overall state-of-the-art. I also tend to encourage research directions that seem useful to a larger community as opposed to those which only serve academic curiosity. Further, I believe it is important to maintain relations with my former students and to help in advising them as their careers evolve.

Computer-Aided Instruction & Web Developments

I have been engaged in computer-aided instruction at various levels since 1988. These activities were first motivated by the need to establish an independent computational facility to be used for both my research and teaching activities. It was a great help to receive the NSF PYI award in 1989 which allowed me to build a powerful computing environment. The first member of the laboratory was a multi-processor Apollo workstation running an operating system referred to as "Domain OS". At such time, I had to become familiar with the innerworkings of a UNIX operating system. The lack of system administration activities, at that time, led me to learn a great deal about computers, operating systems, and system administration. As time elapsed, I added a number of Hewlett-Packard workstations, running earlier versions of the HP-UX operating system, and later moved towards the fascinating platform called "NeXTSTEP". The relative ease of use of NeXTSTEP combined with the stability of its core UNIX kernel encouraged me to expand the emerging laboratory into a larger computational environment. The laboratory grew to include 22 NeXT workstations, 3 HP-400 workstations and an HP-755 server. I have been responsible for the various aspects of setting up this laboratory including purchasing decisions, hardware initialization, software installation, networking and general system administration. This laboratory has been a valuable resource to my research group as well the department for 5 years.

The release of alpha versions of the first web browser called “Mosaic” by the National Center for Supercomputing Applications (NCSA) in 1994 has attracted my attention to the emerging potential regarding the utilization of the Internet to introduce a truly new learning model.

During the fall of 1994, I started a number of pilot experiments utilizing the new Web technology as a *supplement* to in-class teaching. Such efforts were motivated, at first, by the departmental commitment to administer “service courses” to other engineering students. These service courses, such as introductory physics, statics and dynamics, strength of materials, etc., are required of most engineering students. At a large public university this quickly leads to large course enrollment. Furthermore, most of the students in these courses do not have Physics or TAM as their home departments. Thus, conventional vehicles for disseminating information, such as bulletin boards or notes in mailboxes may be ineffectual or unavailable.

In TAM, our “philosophy” is to utilize as much of the commercial software development as we can, which means remaining conversant with that technology and constantly attempting to adapt it to educational needs. Thus, I have been developing an extensive web-site for mechanics, that we call “Mechanics on the Internet” (MOTI).

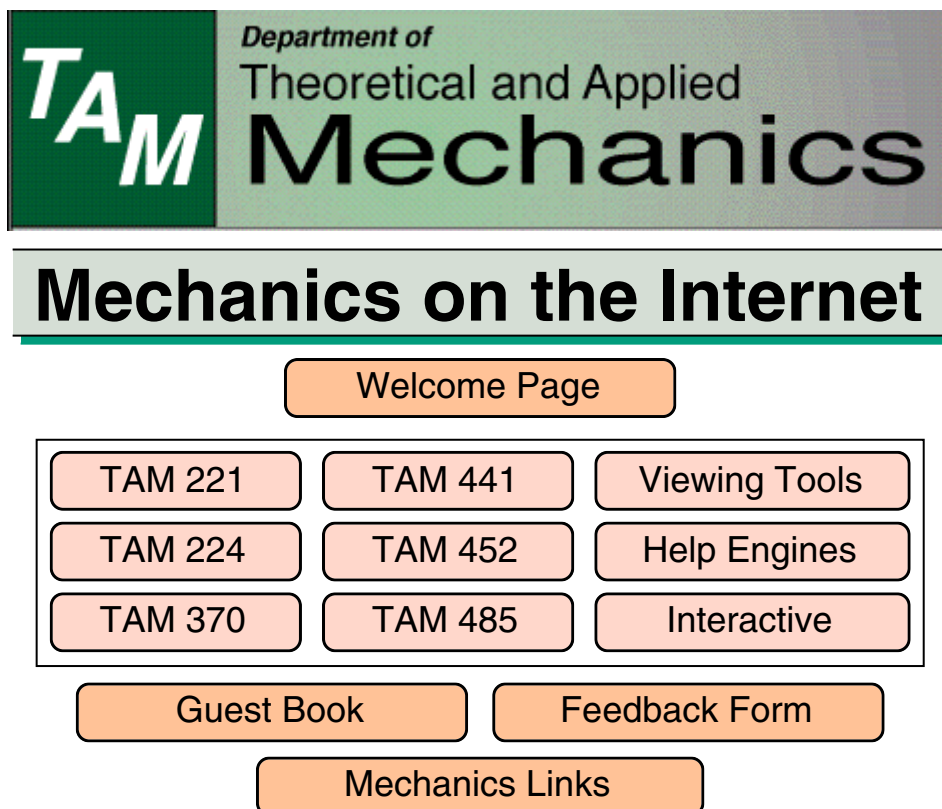


Figure (3) - The home page for the pilot web site:
Mechanics on the Internet at Illinois.

The MOTI web-site currently includes materials for six courses, ranging from undergraduate to

graduate levels, help engines, search engines, electronic discussion groups, an e-mail interactive interface, an interactive Webster dictionary, as well as interactive interfaces to commercial mathematics software, such as Mathematica, MatLab and Maple. Figure (2) shows the home page for the MOTI web site (<http://e2.tam.uiuc.edu>) while Figure (3) illustrates the primary ingredients of the MOTI web site.

Both the CyberProf and the MOTI projects are attracting interested parties worldwide. These projects show how the Web can be used as a very flexible medium for a new model of learning. Web-based instructional materials are used by on-campus students as a valuable supplement to lectures and discussion sections. They are useful for students who fall behind, or miss a class for any of a variety of reasons. The materials on the Web are always those produced or approved by the instructor, and should provide a superior resource to a student than copying notes from a friend. Assignments and worked problems are always the "official" versions, and we have quickly evolved to a mode of operation where we do not hand out paper assignments or solutions to students (although we still collect and grade assignments done by students).

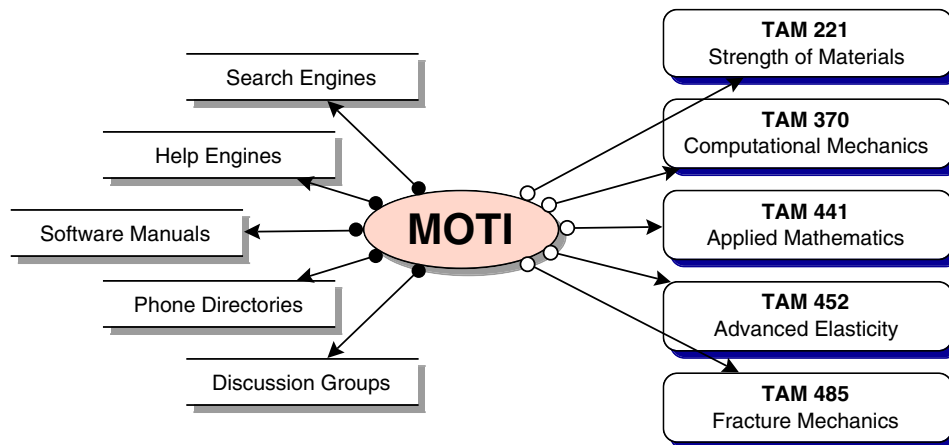


Figure (4) - A schematic illustration of the MOTI web site.

This MOTI site grew out of our departmental homepage. We added several features to this homepage, such as announcements of seminars and special events, a weekly listing of all seminars of interest to mechanics faculty and students from different departments on campus, abstracts of the reports in our departmental research report series, a listing of conferences in mechanics that we were aware of, and so on. As has been the experience at many institutions in relation to courses we first saw simple course outlines and logistics posted by several faculty. Then more comprehensive collections of course material were prepared, including lecture slides, in some cases lecture notes or supplemental materials not covered in class, homework problems and, in due course, their solutions, exams and their solutions, etc. At about this stage we understood how to include interactive program modules in our pages. Thus, we can now put examples of code written in, say, *Mathematica* and the student can edit and execute this code, including the drawing of graphs and other figures,

without having the *Mathematica* program resident on his/her machine. In this way the content of the web page becomes genuinely hypertext, and the beginnings of new types of textbook and lecture note material are clearly discernible. We also understood that if we were going to serve large populations of students, say 200-300 in a given course, we needed to have dedicated servers to handle the requests. Thus, at this stage we secured funds for four computer servers dedicated to Web-based instructional materials.

The use of the Web for teaching, and more ambitious projects such as those mentioned above, are beginning to have an impact on the academic culture in the research university in several ways. First, the technological challenges in producing well-thought-out instructional materials, and the general mastery of the technology of producing Web-pages puts aspects of this activity close to the research frontiers. Second, the availability of course materials for all to see is a different mode of operation for most faculty. The days of the informal hand-written notes, or the bungled derivation quickly erased from the blackboard are numbered. Third, the asynchronous element, and the ability to use communication tools to access several instructors or fellow students at once, improves the dialog in the course between student and instructor and among the students themselves. This leads to heightened motivation, and presumably improved assimilation of the material. Fourth, through the potential of distance education and attendant revenues this type of teaching is being watched closely by administrators and business affairs people in the university. The potential for licensing software tools and for selling course modules that can be delivered over the Web is of considerable interest to several service and administrative offices on our campus. We expect all these trends to grow quickly in the next few years.

The Global Campus

The crowning achievement of my interest in utilizing modern technologies in the classroom teaching is the emergence of the Global Campus Initiative during my sabbatical leave (July 1996 - July 1997) in the REGIONAL INFORMATION TECHNOLOGY & SOFTWARE ENGINEERING CENTER (RITSEC), Cairo-Egypt.

The Global Campus Initiative was originally conceived during my sabbatical leave at RITSEC following a year-long experimental phase which involved the web-based instruction of an engineering graduate course (TAM 485 - Fracture Mechanics) from RITSEC to registered students at the University of Illinois at Urbana-Champaign, USA. The early drafts of the concept date back to the summer of 1996 while the "Initiative" document emerged towards the end of June, 1997.

The Global Campus Initiative seeks the establishment of an enabling framework that brings first rate educational material to learners and educational institutions worldwide. The GC is not a university in the traditional sense and it does not grant degrees. Instead, it empowers both educational institutions and students worldwide through the compilation of a novel curriculum derived from offerings of first rate institutions in a wide spectrum of disciplines. This is accomplished through the collaboration of many partners as illustrated in figure (5). The components of the GC framework include a network of *provider* institutions, an executing/development organization, a network of *client/user* institutions along with a catalytic/coordinating organization.

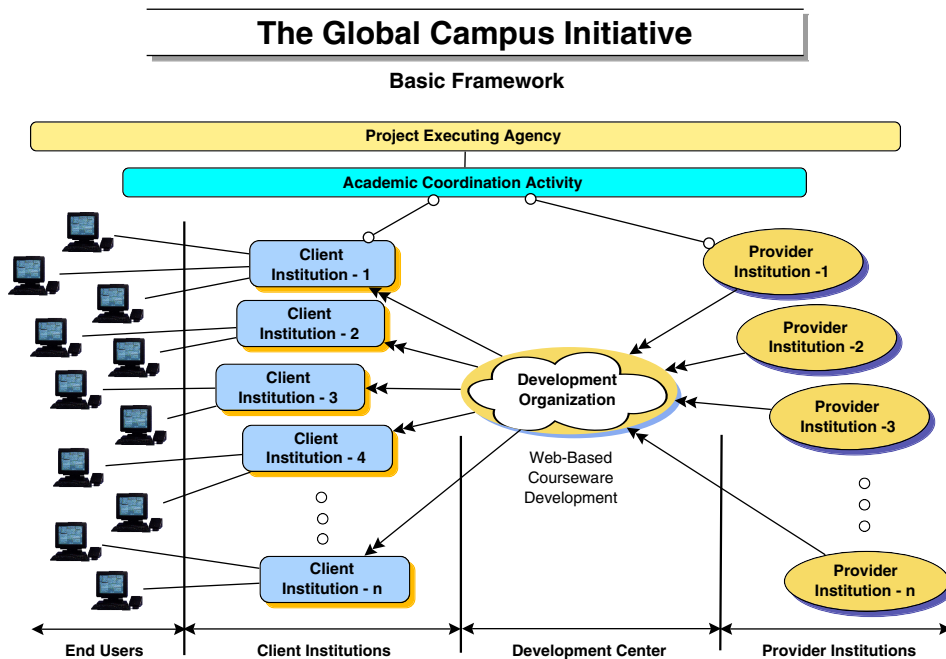


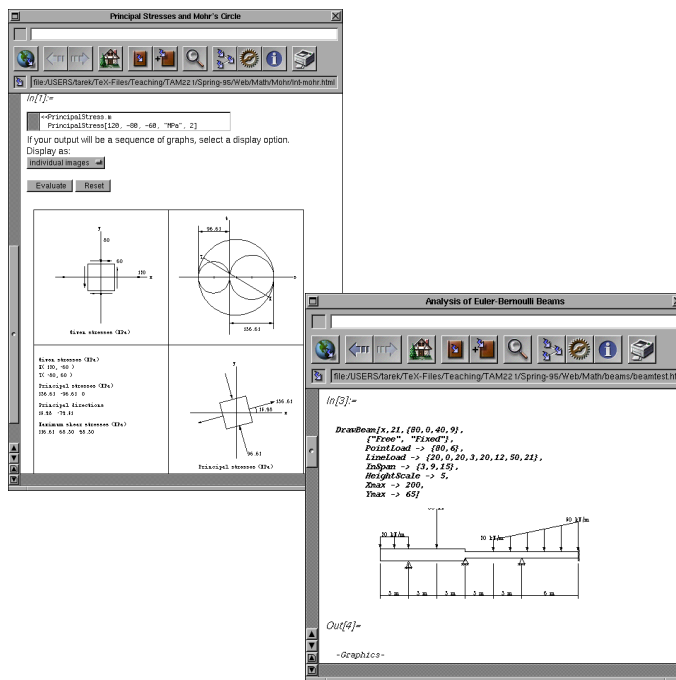
Figure (5) - The Global Campus Framework

Intellectual content is provided by faculty at provider institutions which is then converted to appropriate electronic format(s) by dedicated professional developers at the development organization. The resulting collection of educational resources will be available in many electronic forms (e.g. web-based, CD-ROM) and the resulting GC catalogue will be made accessible to participating client institutions. The client (user) institutions determine the most suitable way by which they take advantage of the GC offerings. Students enroll in local institutions at their respective countries. If the institution (to which a student enrolls) happens to be a participating GC member, then the student is going to be offered numerous education options which include offerings from the GC catalogue.

The GC courseware is not just an electronic duplicate of the original course material. The GC courseware is a new breed of education material which takes full advantage of the emerging web and multi-media technologies in order to achieve an efficient, yet enjoyable, learning process. The GC courseware utilizes the new programming languages (e.g. JAVA, JAVA SCRIPT, PERL, etc.) to bring interactive simulations and virtual laboratory experience to the course material. Complex concepts are introduced in innovative new ways. Full linking to vast resources available worldwide introduces new levels of complexity to the courseware. The final GC course is envisioned to be a dynamic resource that will prove beneficial to both students and instructors alike.

During my stay in Egypt, I introduced the concept of the Global Campus to officials in the UNESCO regional office who endorsed the idea and encouraged it continuously. In fact, the UNESCO-Cairo Office witnessed the signing of a Memorandum of Understanding between RITSEC and the College of Engineering at Illinois on August 14, 1997 whereby the College of Engineering (Illinois) becomes

the Global Campus first provider institution.



Following the signing of the Memorandum of Understanding, I was assigned by the College of Engineering at Illinois to serve two additional years in Cairo, Egypt as the executive director of the Global Campus.

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