UNIVERSITY OF SOUTH FLORIDA
COLLEGE OF ENGINEERING

College of Engineering – Interdisciplinary Scholarship Program
Spring 2009

The recipients of the spring 2009 Interdisciplinary Scholarship Program internal grants are Adriana Iamnitchi (Computer Science & Engineering) and Dmitry Goldgof (Computer Science & Engineering). This grant opportunity is intended to encourage interdisciplinary efforts between COE and our sister USF colleges, involving research or instructional activities. Furthermore, it is expected that the projects will produce exceptional scholarly output, include meaningful involvement from the partnering college(s) and strongly align with the strategic plan of the university. The College of Engineering is extremely pleased to support the projects of Drs. Iamnitchi and Goldgof, summaries of which are provided below. We also would like to thank the **Schools of Natural Sciences and Mathematics, and Art and Art History** for their strong support of the projects.

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Adriana Iamnitchi, Computer Science and Engineering
Robert Lawrence, School of Art and Art History, College of The Arts

Project: Tango Panopticon
This project combines Iamnitchi's research in socially-aware support for mobile applications with Lawrence's art interventions, which involve unexpected dancing by large groups of people in public spaces. This collaboration will culminate in an international synchronous public art event in 6 worldwide locations. All 6 sites will be connected in a live virtual network via smart phones streaming live video through Iamnitchi's open source software. Additionally, this live video will be available to anyone worldwide via the Internet.

This collaborative research adds significant dimensions to both investigators' research. For the computer science aspect, the project will stress-test the Mobius architecture and services (http://www.csee.usf.edu/dsg/mobius/) running in a peer-to-peer overlay at an unprecedented global scale. Additionally, there will be development or integration of two new mobile applications: streaming video from a mobile phone and socially-aware content-delivery with power constraints.

The research will contribute significant refinements and conceptual expansion of an already successful art series (http://www.tangointervention.org). A hybrid real/virtual cultural event of this kind has never been produced on such an international scale.
Rather that playing to a local audience in one city, Tango Panopticon will unfold simultaneously before thousands of people on an international scale, and via the Internet to many thousands more. Due to the extreme innovation of the project, the use of cutting edge technologies, the inherent visual spectacle of the interventions, and the synchronous multiple international arenas of

presentation, it is expected that the event and the project as a whole will receive considerable critical and press attention.

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Dmitry Goldgof, Computer Science and Engineering
Dmitry Khavinson, Department of Mathematics, School of Natural Sciences and Mathematics, College of Arts and Sciences

Project: Collaborations in Fluid Flow and Elliptic Growth Phenomena: Imaging and Modeling

This activity aims at broadening multidisciplinary research and instructional collaborations between Departments of Computer Science and Engineering and Mathematics. Our goal is synergistic interdisciplinary research combining expertise in mathematical modeling of elliptic growth phenomenon in fluid dynamics and non-equilibrium physics with expertise in video processing and analysis. This is enhanced with the visit of the international expert in computational fluid dynamics.

First, we focus on developing novel video analysis algorithms to detect moving waves, determine wave regimes and compute controlling film flow parameters based on video data. The flow of a liquid film over a rapidly rotating disk has many applications in chemical, engineering, and bioengineering fields. Spinning disk reactor creates a large interface between liquid film and gas for heat and mass transfer. Video observations provide effective way to record the film flow and to track the actual flow parameters. The fluid flow parameters and characteristics are calculated and compared with the solutions of the relevant computation fluid dynamics models.

Second, we concentrate on elliptic growth phenomenon and dynamics of generalized Hele-Shaw flows and build on a recent activity in the studies of mathematics and physics of moving boundaries. The study of dynamics of singularities of moving boundaries in general Hele-Shaw processes requires new results in deformation theory of Riemann surfaces, quadrature domains with singularities, integrable systems and integrable hierarchies. Some of such physical processes can be observed and recorded by video sensors. Visual observations validate the theoretical predictions and verify the software implementation of the models.

Anticipated Outcomes:

- Advancement of collaborative research in the area of fluid flow observations, submission of conference and journal papers describing collaborative work.
- Submission of NSF proposals on Film Flow on a Spinning Disk Reactor and on Elliptic Growth Phenomenon in Fluid Dynamics
- Graduate student education through collaborative seminars, collaborative study supervision and development of graduate Applied Mathematics course