McMaster University:

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P1.

First of all, I want to thank the Selection Committee for giving me a chance to visit the campus and to do a presentation here. This is a great honor to me and I am very grateful.

The purpose of my presentation is to show you my vision and goal for this Department and my action plans to lead this department to reach the goal. The actions plans cover research, education and service. In addition, I will also discuss my management style. This presentation will take about 15-20 Minutes.

After that, I will answer questions.

P2.

Obviously a new Chairman should have vision for the Department's future. Before addressing the issue of vision, we need to know what we are facing.

The world we are facing now is more inter-disciplinary and collaborative. The problems we need to solve today

usually require techniques from several different disciplines, such as problems in bioengineering or bioinformatics. Therefore, communication and transition of ideas and results between different disciplines must be based on a language people can understand. Visualization techniques are obviously the easiest and most efficient way to communicate ideas and results between different disciplines.

Another important issue is Internet computing. Internet, one of the most important inventions of human being, has simplified and improved our lives in many ways. Through Internet, people from different countries or continents can work together as if they are in the same room. Information can be accessed anywhere in the world. ¡°Distance¡± is no longer a barrier in human collaboration. Because of these, human being productivity has increased dramatically during the past decade. Obviously whoever has a dominating role in the design and development of Internet infrastructure and Internet computing (including the handling of Internet problems such as spam, viruses/worms, digital copyrights, identity theft, electronic fraud, electronic warfare, etc.) will have a bigger share in the control of human lives and the world's order.

What we can see is, computing today has reached a point that only those who know how to use internet computing as a core and visualization techniques as a communication means to

integrate/combine different computation models and computation tools to solve multi-disciplinary problems in urgent areas such as SECURITY and PUBLIC HEALTH will excel.

P3.

P4.
New level of success means better reputation and rankings.
A higher ranking would not only attract more high-quality students to this department, but also increase its chances in getting external supports.

P5.
We need an Action Plan for each of the Research, Education and Service Areas.
My action plan for research include the following items.1. ... 5.
6. Pushing for creation of technology centers in the college such as
   Center for Visualization and Virtual Environment
   Center for Internet Computing
   Center for Bio-Informatics

The importance of these items is not necessarily sorted in this

order, but I do believe the first item is the most important thing we should do.

I will (briefly) address these items separately in the following, starting with item 3 because information used for this item will be used by item 1 too.

P6.
It is well known that the top CS Depts are much larger.
E.g., MIT's no 1 ranked CS program has 91 faculty.
Stanford's no 2 ranked CS program has 51 faculty.
CMU's no 3 ranked CS program has 48 faculty.
Berkeley's no 4 ranked CS program has 46 faculty.
Cornell's no 5 ranked CS program has 50 faculty.
And they all have large number of PhD students and annual PhD graduates.

By the way, Waterloo's CS dept has 73 faculty,
Toronto's CS dept has 68 faculty, UBC's CS dept has 54 faculty,
McGill's CS dept has 31 faculty, Alberta's CS dept has 45 faculty,
Simon Fraser' CS dept has 47 faculty (Burnaby campus).

P7.
The good thing is, one does not (always) have to be large to

be highly ranked. Small CS depts can be highly ranked too.
E.g., Cal Tech's no 15 CS program has 15 faculty members only.
Rice Univ's no 19 CS program has 18 faculty members only.

P8.
The key to improve in rankings and reputation is
through growing selective areas of excellence.
(The areas of excellence of Cal Tech's CS dept are:
vision/graphics, algorithms, networking.
The areas of excellence of Rice's CS dept are:
AI/robotics, graphics/geometric modeling, systems.)

We will continue to expand the strength of all our existing
research areas, but we will put extra resources into two or
three selected areas that are most critical to the future of
this department.
(and have the best chance to excel nationally
(i.e., bio-informatics, vision/graphics, networking)).

P9.
One thing in common for all these top CS departments is,
they all have good size of research funding per faculty member.
Each faculty at MIT has $685,000 per year.
Each faculty at Stanford has $730,000 per year.

The smaller depts,
such as Cal Tech has $500,000 per faculty per year.
Even Rice has $350,000 per faculty per year.

P10.
For this dept to improve reputation and rankings, the most important issue would be to significantly increase the funding of this dept, whatever it takes.

We will encourage faculty to write more high-quality research proposals each year (3-4), and explore our opportunities with other federal agencies such as Army, Homeland Security Dept, NIH and private companies such as ....
We will use Ontario's Parliament members to build tighter connections especially with Army and other federal agencies, places with huge amount of cash to spend.

P11.
Each faculty member should try to publish 4 journal papers and 4 conference papers in high quality journals and conferences.

We will create a list of top-tier journals and conferences and second tier journals and conferences in various research

areas and faculty members will be evaluated based on the quality of their publication.

We encourage faculty to publish half as many papers in top-tier journals and conferences than twice as many papers in second-tier journals and conferences.

P12.
Larger startup funding is necessary to compete for excellent new faculty members. It is also necessary for new hires to quickly build up a strong research team to compete for Professional visibility and to compete for CAREER awards.

We should know that to build a larger research enterprise, we need to invest in research resources.
We will work with the College to increase the startup funding by 50% at least.

P13.
I will address this issue in the Education part.

P14.
The sixth item is to push for creation of technology centers in

the college such as

Center for Visualization and Virtual Environment
Center for Internet Computing and Security
Center for Bio-Informatics

P15.

Technology centers have several advantages that allow us to build stronger research ties with industry.

First, a technology center can provide combined strength of several areas. Therefore, a technology center can handle technical problems in a broader range.

Second, the cost structure of a technology center is low because faculty associated with the center usually are not paid by the center and the students working there are paid much less than professional engineers.

So it is cheaper for a company to out-source its research projects to a technology center than doing the projects themselves.

This "Technology Center" model has been working successfully at several places, including U Southern California's Information Sciences Institute, Johns Hopkins' Applied Physics Lab, and Georgia Tech's GTRI.

P16.

The challenge universities are facing now is the same: a world that is more INTER-DISCIPLINARY, COLLABORATIVE, and GLOB

Computer Science Depts of this century need to produce students who are more adaptable and flexible, besides being technically proficient.
This is true for both undergraduate and graduate education.

P17.
My Action Plan for Undergraduate Education includes the following items.

The first plan is to increase the number of undergraduate students from 228 currently to 340 in 2010.

It has been a national trend that the number of students attending CS is declining.
But the total number of students interested in this discipline is still very large nationally and in the province of Ontario.
We should market our undergraduate program to the large number of prospective students in the province of Ontario and the Lake area.
Build partnerships (exchange programs) with universities in China, Malaysia, Korea, Taiwan, Japan to attract more foreign undergraduate students.

Need to redesign our website.
If we can let a student know more about our strength, we have a better chance to recruit that student into our program.
Providing an informative website is the cheapest and,
yet the most efficient way, to recruit students.

P18.
Quality certainly is more important or as important.
Our next plan is to increase the quality of undergraduate students. We need to attract more excellent high school graduates to UMC. The first thing we will do is to raise funding for undergraduate scholarships in CS.
Other actions include organizing province-wide promotion trips to high schools to talk to students directly,
Holding prograqmming contests and
providing more information about our program
on our website.

P19.
The 3rd plan is to get the undergraduate program accredited by "ABET" in 2 yrs. UK's CS Dept went through the ABET evaluation process last year.
I was a member of the ABET committee of UK's CS Dept.
I was involved in every detail of the preparing process.

So, I have enough experience to lead such a process here.
This might not be as urgent, but it needs to be done eventually.

20.

I consider the job of a programmer a manufacturing job.
A company would out-source it if at all possible.
So, in addition to giving the students a good training on computer science in the broad sense, we should also give them a chance to be more specialized in one or two Areas (such as the current Game Design option), in a sense, giving them something that can not be out-sourced to a foreign country yet.
We do this by creating, for instance, certificate in vision/ graphics, networking or bio-infromatics, in addition to the current Game Design option.
The students take some extra curricula to get the certificate.
With a certificate, a student would not only have an edge when looking for a job, but also has less chance to be laid off because of the extra strength.
I am currently responsible for developing a certificate in vision/graphics for UK's CS dept. So, I have experience to lead such an effort here too.

P21.
In addition to increasing the width of the students knowledge, we should also increase the depth of their hands-in capability.
Our students must be able to design, not just implement.
They must be able to solve multi-disciplinary problems.
By looking at your course list, I can tell there is already such an effort in that direction in this dept.
But we can do more by requiring the projects of those courses to be involved with at least one of the faculty's research grants.

P22.
My Action Plan for graduate education includes three items:

1. Increase the number of PhD students
2. Improve the quality of PhD students
3. Improve the retention and graduation rate of PhD students

For the first item, we will try to increase the total number of graduate students by 30% (from 100 to 130), in four years, but with a favor in more PhD students.
The goal is to increase and the total number of PhD students by 70% by 2010 (from 29 to 50).
(currently, the number of graduate students is 100: 29 PhD and 71 Masters)

This goal will be achieved by attracting more graduate students into our PhD program through the following steps:

(a) PhD students have the highest priority to be supported
(b) A PhD student with a MS in CS before joining the PhD program can not get a MS degree here if they change their mind after joining our PhD program
(c) do not support MS students with TAships or Fellowships
(d) Increase RA positions for PhD students by increasing our external research funding by 100% by 2010.

A more informative website can also make recruiting graduate students more effective.

P23.
We will improve the quality of graduate students by
(a) encouraging our good MS students to apply for our PhD program
(b) we will try to provide paid summer internships, 6-month or one-year internships to top CS juniors or seniors at top universities in China, India, Taiwan, Korea, ... with dept fund.
Once a student is familiar with our department, especially when a student likes his/her research experience here, we have a better chance to recruit

him/her back into our PhD program. I got this idea from the internship program of MicroSoft Research Center in Beijing (called MRCA). Their internship program not only created excellent research results (those students made significant contribution to the research work of MRCA by publishing papers in prestigious conferences like SIGGRAPH, ... etc), but also provided them with an influx of excellent new employees because most of those students joined MRCA after they graduated from their colleges.

(c) our PhD student stipends must be competitive.
We will make sure our PhD students are paid at least as much as our benchmark universities.

24.

We will

(a) develop a more exciting and flexible curriculum
(b) offer courses more efficiently
(c) ensure every PhD student get financial support

We will make our graduate curriculum more exciting by introducing more courses in the experimental CS areas and areas of current interest such as: Computer Graphics, Image Processing, Computer Vision, Multimedia Systems, Computer Animation, Distributed Operating Systems,

Computer Networks, Virtual Reality, Advanced Computer Networks, Neural Networks, Cryptography, Medical Imaging, Bio-informatics, etc.
(note that the networking and image processing are emphasized Differently in CS depts and ECE depts. ECE people tend to focus more on building hardware while CS people tend to focus more on developing software). Another example is CAD. CAD people in ECE focus on circuit design while CAD people in CS focus more on geometric shape design.)

But more importantly,
we will make our graduate curriculum more flexible
by consolidating courses in the curriculum so that MS and PhD curriculum is not spread over too many courses.
This will make sure most of the courses are offered at close to full capacity so that there will be no need to cancel any courses.
Therefore, PhD students can finish the required courses and and enter the research stage as soon as possible.

P25.
Service is also a very important mission of us.
The Chairman of the dept should work closely with DGS and DUS to ensure every student gets proper advice for every thing related his/her study in the department.
In particular,

(a) To make the advising process more efficient for us and the students as well, we will consider the possibility of doing group advising, i.e., instead of meeting with the students individually, we provide a chance for all the advisors to meet with all the advisees in an advising area at the same time so that one trip is all it takes for everybody.

(b) For graduate students who do not have a permanent supervisor yet (the duration of that time sometime could be as long as two years), the department should assign a temporary advisor to each graduate student to help with his/her academic problems.

(c) We will hold regular meetings (at least once a semester) to discuss the progress of our MS students and our PhD students. Each advisor, permanent or temporary, is responsible for reporting the progress of his/her advisees so the department (DGS) can make proper decision on the next stage for each student. These meetings also determine if a student should be financially supported by the department subsequently.

P26.

To help faculty get involved more in professional activities

(to increase visibility of the dept),

(d) the dept will provide administrative support within its power to faculty who are involved in professional activities such as conference chairman, program chairman, editor-in-chief, ...

(e) the dept will help faculty to seek financial assistance from the university or external sources to hold conferences and symposiums on campus or in Toronto area.

P27.
I prefer a transparent, bottom-up approach. I treat everybody fairly and honestly. I like to do things by book.

Responsibilities of the dept chairman should be clearly defined and stated, so everybody knows exactly what the chairman can Do and cannot do. Everybody should also know how business of the department is conducted and operated. For that purpose, The Department Operating Rules and Procedures will be reviewed and revised if necessary.

Policy making within the department will be as transparent as possible, through various committees (executive committee,

hiring committee, graduate committee, undergraduate committee, equipment committee etc) and faculty meetings to reach consensus on departmental issues.

The Department will ensure that each faculty member is provided with appropriate administrative and technical support. For that purpose, the administrative and technical support structures will be reviewed and revised if necessary to make sure the dept has sufficient support in both areas.

Every employee of the department will be treated as a first-tier employee. We will improve the morale and effectiveness among the staff members by providing appropriate recognition and competitive salaries to all staff (administrative or technical) compared to our benchmark universities.

P28.
I believe the most important job of the University, the College, and Department is to provide an environment that everybody can reach his/her full potential. I will do my best to make this department

- a department with a bracing atmosphere,
- a department with a strong sense of community, and
- a department with intellectual vigor.

P29.
This ends my presentation.
I will be glad to answer questions.

P30.

P31.
The areas of excellence of Cal Tech's CS dept are:
vision/graphics, algorithms, networking.

P32.

P33.
Because of the "reputation" of McMaster,
and because of my "ambition".

McMaster has one of the top Engineering Colleges in Canada and North America. But there is always room for improvement. With its size and reputation, the Computing and Software Engineering Department has the potential to grow into a top30 Or even a top20 CS department in North America.

I have the vision, leadership and experience to take this department to such a level.
The key is to build on selective areas of excellence while further improve existing research areas and its graduate and undergraduate programs.
I want to have a chance to work with the College and the Department to make this happen.

P34.
The university was established in 1881.
Currently, the university has over 23,000 students.
Considered Canada's "most innovative" university.
I have heard people calling McMaster "Canada's MIT".
Named Canada's most innovative 'medical doctoral' university eight times in the last 11 years Maclean's annual ranking of universities.
The 'McMaster Model' - a student-centered, problem-based, interdisciplinary approach to learning - has been adopted by universities around the world.

P35.
I applied for this job not because McMaster is a Canadian university, but because of its "reputation" and my "ambition".

McMaster has one of the top Engineering Colleges in Canada and North America. But there is always room for improvement. With its size and reputation, the Computing and Software Engineering Department has the potential to grow into a top30 CS department in North America.
I have the vision, leadership and experience to take this department to such a level.
The key is to build on selective areas of excellence while further improve existing research areas and the undergraduate and graduate programs.
I want to have a chance to work with the College and the Department to make this happen.

P36.
I have strong experience in "research", "education" and "entrepreneurship". I know how to manage/handle challenges that we will be facing to reach a higher status in research, education and service.

I have the attributes required of a department chairman, such as "leadership", "vision", "know-how", and "communication skills". I know how to lead, where to lead, and how to motivate our colleagues to achieve their potential.

These points are not only supported by my resume but also

by people who know me well.

P37.

P38.
For a business to make a profit, there are basically two strategies: providing a product or service that nobody else can provide, or providing a product or service that is better than anybody else's.

P39.
A business owner needs vision to set up the right goal and right strategy. To reach the goal, he needs know-how to carry out the strategy. I have both.

P40.
When we first started the business, the goal was to commercialize some of my previous technologies (in hardware-supported curve/surface rendering). The strategy was to win SBIR/STTR (small business innovative research program/small business technology transfer program) grants to support operation of the company. It turned out that applying for SBIR/STTR grants was not even

necessary because with the contribution of my research to IBM, and later to Olympus and Ford, the company got enough projects to start with and prosper. This shows my capability in putting my research in a strategic position that enables us to build a work relationship even with industry giants.

For a small company like ours to get projects from industry giants like IBM, Olympus and Ford, there are only two reasons:
PERFORMANCE and VISION.
We must gain their trust of our performance and we must convince them the strategic height of our VISION.
I have both.
For each grant I did for outside companies, I always walked extra miles for everything we did and I always made sure that we delivered exactly what have been specified in the Grant. Therefore, I was able to win trust of highly demanding industry giants. Besides, I have the vision to design sophisticated systems that meets the expectation of these industry giants as well. Therefore, I was able to win contracts from these companies subsequently even though the size of our company is really small compared with other companies.

P41.

But my most important attribute is my vision in developing Strategic product for the company.
For a period of nine years, the revenue of our company came from delivering services to IBM, Olympus, or Ford, and we made a profit in most of these cases. But our goal was constantly to develop a successful product of our own. The company eventually developed a very successful strategic product that can save the car redesign process by hundred of million of dollars. The idea of the product is the so-called 'constrained scaling based shape-altering' of trimmed NURBS or subdivision surfaces¡®.

By allowing a designer to scale the body of a car in x-, y-, and/or z-direction while holding certain features unchanged, such as holes for the front lights, tail lights, handsets of the doors, or even the entire doors, one can globally or locally modify an existing model in length, height, or width (wheel base) without affecting certain significant features and, consequently, avoid an expensive redesign process.

P42.
The design process of a car usually takes 24 to 40 months, with a cost of about $400 million.

By avoiding the redesign process while altering an existing model, a car company saves both on time and money, significantly.
Our product is the only one of this kind and, consequently, has the entire market share.

P43.
I was the main architect of the project, responsible for everything from system design to global and local testing. This shows my capability in designing a strategy plan for a team and leading the team to reach the business goal of the strategy plan.
Running a business and running a CS dept, to certain degree, are the same, you need vision and know-how for both cases. So, I think my experience in running a business can help me run this department.

P44.

P45.

UK's CS Dept went through the ABET evaluation process last year. I was involved in every detail of the preparing process. So, I have enough experience to lead such a process here. This might not be as urgent, but it needs to be done eventually.

I am currently responsible for developing a certificate in vision/graphics for UK's CS dept. This involves designing new courses and developing study plan. So, I have experience to lead such an effort here too.

I have developed three new courses in Vision/Graphics, Including "computer animation", "free-form solid modeling", and "computer aided geometric design".
"Computer Animation" is a very popular course now.

I coordinated the courses that the Vision/Graphics group teachs on a annual basis.

I also consolidated our undergraduate courses so that the students wouldn¡¯t have to wait for one more semester or even one more year to graduate because the required courses are not available.

So I have experience in most aspects of teaching.

46.

47.

48.

49.

Our startup fund was US$200,000.
This money came from three resources: personal loans, our investment gain on stock markets (both Taiwan and US), and award money I recieved from the Dr. Sun Yat-sun Technology Invention Award in 1985.

50.

Since the startup fund is quite small, so the first contract we received from IBM to implement in micro code of IBM's Trimmed NURBS surface rendering algorithm was very critical

for The early day of the business because it not only provided us with the capital we needed to run the business, but also gave us a good reason to convince other companies to grant us contracts subsequently.

51.

52.
I have more than 30 yrs of teaching experience
(to be specific, 33 years).
I have been a TA (5 yrs), an instructor (2 yrs), and
A professor (24 yrs). So I know all aspects of teaching.

53.
My teaching has three goals:
(1) to make sure that students understand the course materials well,
(2) to make sure that students know how to use/apply the materials they learn in class, and

(3) to make sure that the students are evaluated fairly.

54.
To achieve the first goal,
I use a motivation-driven approach in my lecture, i.e., I give the background and applications of the result first, and then explain the theory that leads to the result.

I give many examples in my notes (see, e.g., my CS535 and CS633 notes).

I encourage the students to be involved and active during lectures. (for those who find it difficult to do so, I welcome them to ask questions or make comments after class.)

I make all my class notes available on line so that, instead of copying my notes in class, they can closely follow
my lectures on course materials.
(My class notes such as CS633, CS631, CS535, and CS321 have been used by some of my students and colleagues in their own classes.)

55.

To achieve the second goal,

1. I give applications for each covered result;
2. I provide students with sample programs to help them initiate their work (see my web pages).
3. I encourage students to share their ideas.
4. I award students with extra credit if they have new ideas on assignments.

56.

To achieve the third goal,

I always let the students know at the outset of the course exactly what is expected.

2. I clearly specify the requirements of the course such as materials to be covered, grading policy, program requirements (see, e.g., my CS535 and CS633 programming requirements), late penalty, and numerical scale to be used in the evaluation, on the first day of class.
3. I provide students with solution sets for all homework assignments and exams (see my web pages) so they would not only know the solutions to the questions, but also know if their works are graded fairly.
4. I have different expectations for graduate and undergraduate students though.

5. For an undergraduate or programming-extensive course, the students are evaluated based on two subjects: programming assignments and tests. I usually put equal weight on both sides so the effort of the students can be evaluated fairly.
   However, I encourage students to do critical thinking and they get extra credit if they do so such as providing comments or improvement on existing techniques.
   For a seminar course or advanced topics,
   I evaluate the students mainly based on the quality of the work, i.e., I will follow the numerical scale, but a student with good ideas will get more extra credit than the ones who don't.

57.

58.
Quality of teaching
CS633: 3.7 out of 4
CS631: 4.0 out of 4
CS535: 3.8 out of 4
CS321: 3.9 out of 4
I wouldn't say I am an excellent teacher, but I do believe I am a great teacher and my students enjoy

my teaching very much.

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60 : My Research areas: ...

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As the co-owner of a successful hi-tech software company for more than 10 years,
I also have extensive experience in industrial R&D and entrepreneurship.
So, I have in-depth knowledge of research in both the academic and private sectors.

61: Reseach record: 120 research papers ...

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Finish the slide then say:
I am the sole PI of 22 of these 26 grants.
I have been Continuously supported by NSf for the past 13 years
I have also been funded by Fortune 500 companies: such as IBM, Ford, Honda (2), Olympus
Some of them are quite large, including my own business.

Hence, in addition to writing proposals and managing research projects, I also have extensive experience in leading and supervising research projects.

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62 : Important Research Contributions ...

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I have made important contributions in both areas.

1. I was the first person to develop hardware device to generate/render parametric curves and surfaces [79]. This work won me the prestigious Dr. Sun Yat-Sun Technology Invention Award.
2. My joint work with Ardy Goshtasby: "A Parallel B-Spline Surface Fitting algorithm" [45] initiated a new research area, parallel spline algorithms. The area is still active today.
3. The best result in this area was obtained by me, by showing that constant time complexity is possible for parallel B-spline surface interpolation [34].

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63 : Continue on Contributions ...

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4. Together with Brian Barsky at Berkeley, we developed

the so called "Interproximation" technique, a combination of "interpolation" and "approximation".

5. Working jointly with Bill Luken, I developed the most efficient trimmed NURBS surface rendering technique for IBM.
6. I was the first person to work on constrained scaling techniques on NURBS and subdivision surfaces. These techniques make the redesign process of a car or an appliance much simpler and, consequently, can save those industries money and time in making changes to an existing model.
7. I have also worked extensively on subdivision surfaces. One of only a few who have played critical role in this area.

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64 : Professional recognition:

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During the past 8 yrs, I have been an NSF panel member 6 time and 3 of them are for CAREER awards.

I am currently an editor of two international journals.

I have been a program committee member for more than 20 international conferences.

This year along, I am a committee member of 4 international conferences.

So, I have built a reputation among peers in my own research areas.

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65 : Current Research Projects:

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Currently, I am working on 4 research projects.
Most of them involve subdivision surfaces.
Two of them are funded by NSF. I am the PI of three of them. The first one, Virtual 3D Plastic Surgery, is challenging because it requires techniques from several different disciplines: plastic surgery, compute science, micro-biology, physics, ... etc.
This is a very exciting project because its impact can be seen immediately and can change the lives of many people.
(include the two figures I sent Shuhua here)

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66 : Blending and warping

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Here is an example of what virtual plastic surgery can do for you. This is a simple application of blending and warping techniques.

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67 : Morphing and boundary reshaping

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Another example of what virtual plastic surgery can do for you. This is a simple application of morphing and boundary reshaping.

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68 : My research interests:

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My research interests center around the design of graphics and geometric algorithms,
with special emphasis on the modeling of geometric shapes and computation techniques for rendering and geometric problems.
The work spreads over 23 subject areas.

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69 : Current Research

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70 : Recent focus: subdivision surfaces

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My recent research focuses on subdivision surfaces,

the de-facto standard for generating freeform curves and surfaces of arbitrary topology in visualization and animation applicaitons
I will show you some of my work in this area.

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71 : Applications of SSs
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Subdivision surfaces are used almost everyehere now: graphical modeling, games, and animation.

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72 : Commercial packages
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Actually,
Subdivision surfaces have already been used by major commercial software as primary representation scheme, such as: Pixar's Renderman, ...

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73 : What is a SS?
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Subdivision surfaces have several different forms.

But, just what is a subdivision surface?

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74 : Def of a SS

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Given a control mesh and a set of refining (subdivision) rules, a subdivision surface is generated by iteratively refining (subdividing) the control mesh to form new and finer control meshes.

The mesh refining process consists of defining new vertices (face points, edge points and vertex points) and connecting the new vertices to form new edges and faces of a new control mesh.

A subdivision surface is the limit surface of the refined control meshes. The limit surface is called a subdivision surface because the mesh refining (subdivision) process is a generalization of the uniform B-spline surface subdivision technique.

Subdivision surfaces include uniform B-spline surfaces and piecewise Bezier surfaces as special cases.
Actually subdivision surfaces include non-uniform B-spline surfaces and NURBS surfaces as special cases as well.

Therefore, this is the most general surface representation scheme we have so far.

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75 : Why are SSs so special?

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Subdivision surfaces are special
Because subdivision surfaces can do things other
can not.

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76 : One piece rep

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You can represent any shape with just one subdivision surface because there is no limit on the topology of the control mesh of a subdivision surface.

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77 : Boolean operations

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including the results of Boolean operations

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78 : Why is one-piece rep good?
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One piece rep avoids the so-called "crack" (or, gap) problem.
With multi-piece rep, you will always get cracks no matter how precisely the Boolean operation is perfromed.

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79 : Multi-resolution
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Subdivision surfaces are good for internet data transmission because subdivision surfaces are scalable (i.e., having multi-resolution property)

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80 : Real-time scaling (multi-resolution)
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such as this example. Since there is always something on the screen, the user would not get bored.

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81 : Cover both reps

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Subdivision surfaces cover both polygon form and
parametric form. These might not seem so important
to you, but they are important to people in design
and manufacturing.
Polygon form is good for machining, finite-element
mesh generation, and manufacturing.
Parametric form is good for design and representation.
Therefore, you have a rep scheme that is good for
almost anything.

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82 : Features

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Can model any kind of special features: sharp eges,
sharp corners, creases, darts, ..., anything,
through modifying the refining rules or repeating
vertices or edges.

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83 : One thing is missing (keep the LR corner
blank initially. Then do a fly-in on CAD/CAM)

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Nevertheless, subdivision surfaces have not been used by one industry yet. Which industry?

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84 : CAD/CAM.

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CAD/CAM.

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85 : Why?

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Why?

Because for quite a while people did not know how to parametrize subdivision surfaces, and there were no error control mechanism and adaptive subdivision techniques for subdivision surfaces either.

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86 : Slide 86

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These techniques are important.

Without error contorl, we can not ...

Without parametrization techniques, we can not do

things such as ...
Without adaptive subdivision techniques, subdivision surfaces are simply too expensive to use.

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87 : Works on SS parametrization

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Things started to change in 1998.
J. Stam presented the first parametrization technique for Catmull-Clark subdivision surfaces.
Zorin et al presented parametrization technique for Loop subivision surfaces in 2002.
We presented a new parametrization technique for Catmull-Clark subdivision surfaces this year.
Why is a new technique necessary?

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88 : Applications of new technique

For one, the new technique is an explicit representation, you don't need a look-up table to get the value of a CCSS at a given point.
Second, the new technique uses only half the number of eigen basis funtions in the representation.
Therefore, the new parametrization technique is not only

more efficient, but can also be used to compute tangent and normal of a subdivision surface at any given point. Therefore, several things are possible now, such as ...

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89 : Surface Evaluation

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You can compute the EXACT value of a subdivision surface at any point of the parameter space now

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90 : Texture mapping

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You can do texture mapping in a uniform way
The one on the left might look more impressive, but it is the one on the right that is more difficult to do (to keep all paterns in a uniform size everywhere)

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91 : Texture mapping 1

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Can handle objects with holes as well.

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92 : Boolean operations

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Boolean operations can be done more precise and more efficient

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93 : Boolean operations 1 (real time)

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Most importanrly,
boolean operations can be performed in real time.

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94 : Trimming

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Surface trimming is basically a surface intersection process.
With the new parametrization technique, it can be done as efficiently as Boolean operations.

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95 : Adaptive tessellation

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With the new technique, it is possible to have near-optimum tessellation technique for rendering process. The conformty requirement is not an issue at all.

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96 : Animation (fat horse)

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Crack free, real-time animation is possible because the computaiton process is more efficient now and the representation is one-piece.

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97 : What is error control? Slide 97

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Error control is the main factor if a representaiton sheme can be used for CAD/CAM

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98 : Building bridge between two reps

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Error control technique builds a bridge between the parametric rep and the polygon rep.

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99 : The problem is solved

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We have solved this problem completely with three papers,
for both regular patches and extra-ordinary patches.
This is the first one.

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100 : Adaptive subdivision

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The adaptive subdivision problem was solved earlier
(2004)

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101 : Adaptive subdivision 1

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Here is an example that will show you a rep precise
enough (within the given tolerance) but much less
elements in the tessellated result.

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102 :

"Subdivision Surfaces: A representation scheme for all

graphics (including visualization and animation) and CAD/CAM applications"

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Subdivision surfaces, as I have pointed out at the beginning, are quickly becomeing the primary rep scheme for all graphics (including visualization and animation) and CAD/CAM applications.
We are happy that we are part of the team in making this happen.

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103 : Acknowledgement

104: Management Style:

105.
I prefer a transparent, bottom-up approach. I treat everybody fairly and honestly. I like to do things by book.

106.
Responsibilities of the dept chairman should be clearly defined and stated, so everybody knows exactly what the chairman can do and cannot do. Everybody should also know how business of the

department is conducted and operated. For that purpose, the Department Operating Rules and Procedures will be reviewed and revised if necessary.

107.
Policy making within the department will be as transparent as possible, through various committees (executive committee, hiring committee, graduate committee, undergraduate committee, equipment committee etc) and faculty meetings to reach consensus on departmental issues. Committee memberships Will be rotated periodically. Will form an Executive Committee To help the Chairman to handle important department business.

108.
The Department will ensure that each faculty member is provided with appropriate administrative and technical support. For that purpose, the administrative and technical support structures will be reviewed and revised if necessary to make sure the dept has sufficient support in both areas.

109.
Every employee of the department will be treated as a first-tier employee. We will improve the morale and effectiveness among The staff members by providing appropriate recognition and competitive salaries to all staff (administrative or technical) compared to our benchmark universities.

110.
I believe the most important job of the University, the College, and Department is to privide an environment that everybody can reach his/her full potential. So, I will do my best to make this department
- a department with a bracing atmosphere,
- a department with a strong sense of community, and
- a department with intellectual vigor.

111.

112.
Research, teaching and service are all very important.

But research should carry more weight.

113.
For us to grant tenure to a junior faculty member, that junior faculty member must be able to convince us that he is not only strong in research, teaching and service, but is also consistent and persistent. We don't want to give someone tenure and later only to find out that person is relaxing once the job is secured.

We can not guarantee that this is completely achievable. But we can set up a mechanism to ensure every Associate professor and Full Professor work as hard as possible. I plan to use an internal STEP system for both the Associate Professors and Full Professors. The Associate Professor level will be divided into 3 STEPs and the Full Professor level will be divided into 9 STEPs.

114.
Climbing from a lower step to a higher step requires the satisfaction of certain research achievement (number of journal/conference publications, number of externally funded grants, ... etc).

An Associate Professor will be considered for promotion only if he or she reaches the third STEP of the Associate Professor level.

Most importantly, salary status for each STEP will be different. A faculty will be recommended for a raise once promoted from a lower STEP to a higher STEP.
