

UNIVERSITY OF KENTUCKY

College of Engineering, Department of Computer Science

Fuhua (Frank) Cheng, Professor
Tel. (859) 257-6760
Fax. (859) 323-1971

763B Anderson Tower
Lexington, Kentucky 40506-0046
Email. cheng@cs.uky.edu

October 15, 2008

Professor William I. Grosky, Chair
Department of Computer and Information Science
University of Michigan - Dearborn
Dearborn, Michigan 48128-2406

Dear Professor Grosky:

This is a letter in response to your request of evaluating the promotion case of Dr. David Yoon to Full Professor in the Department of Computer and Information Science at the University of Michigan - Dearborn.

My conclusion is: this is an above average case, and I support promoting Dr. Yoon to Full Professor. My justification follows.

Dr. Yoon's research interests are in geometric modeling and CAD. His contribution is mainly in the following two areas: "*reverse engineering*" and "*shape optimization*". His contribution in the first area is the development of geometric feature extraction methods for clouds of points (COP). The approach used by him is "sweeping", i.e., moving a curve/surface/solid (called a generator of sweep) along a path to create a 3D shape. Two techniques have been developed: (1) sweeping a NURBS (non-uniform rational B-spline) curve along a spine curve represented by a NURBS curve, and (2) swept surface construction using B-spline surface interpolation. The first technique covers three choices: *translational sweeping*, *rotational sweeping* and *general sweeping*.

Dr. Yoon's contribution in the second area is the development of a three-stage approach for shape optimization of triangular meshes. The three stages are: *surface partition*, *perturbation based local adjustment*, and *constrained optimization*. Two specific techniques have been developed. In the first case, stage two is achieved by perturbation using Cox-deBoor basis functions over arbitrary polygonal meshes and stage three is done using freeform shape optimization. In the second case, the second stage is devoted to generating shape design variables and the third stage performs a gradient-based shape optimization of the structures by reducing a weighted compliance among all load cases.

I have personally been working on reverse engineering and shape optimization for some time. So I am familiar with these areas.

The idea of sweeping came from a technique called "cross-sectional design based on a curved spine". This technique was initially studied by Gossling in 1976 and later on by Faux and Pratt in their book "Computational Geometry for Design and Manufacture" published by Halsted Press, New York, in 1979. Composite Bezier curves (or, B-spline curves) are used as profile curves and spine curves in both cases.

I found Dr. Yoon and his co-workers' sweeping based feature extraction techniques interesting in that they turned something originally developed for *shape design* into a tool for *shape inference* for COP data. This is a difficult work for COP data because it involves not only *feature identification*, *shape identification* and *matching*, but also *denoising*, *thinning* and *smoothing* operations. Another factor that should be pointed out is, in Dr. Yoon's case, since NURBS (non-uniform rational B-spline) curves are used for profile curves and spine curves, the representation scheme is more general. My understanding is, currently the FRES system can not perform boolean operations on basic features yet. However, it is something that they either intend to develop next or are doing at this moment. So I expect to see an even more powerful sweeping based feature extraction system in the future.

As far as Dr. Yoon's contribution in the so-called "shape optimization" area is concerned, I need to point out that the area is also called "mesh simplification" or "surface simplification" in that they all deal with the problem of simplifying a given mesh while ensuring the original shape is accurately preserved. The first stage in Dr. Yoon and his co-author's technique is to partition the given surface along sharp features so that simplification is only performed in regions without features and are relatively flat. The core of the work is in the second and the third stages. The second stage is a local modification stage and the third stage is a constrained optimization process. The perturbation scheme designed by Dr. Yoon and his co-worker for the second stage has its merit, but they obviously did not know the existence of the following two papers which allow a more powerful and flexible simplification process to be built. For that reason, I would say their contribution in this area is not as significant as their contribution in the first area.

- M. Garland and P. Heckbert,
Surface simplification using Quadric Error Bounds,
SIGGRAPH97 Conference Proceedings, 209-216, 1997.
- J. Cohen, M. Olano, D. Manocha,
Appearance-Preserving Simplification,
SIGGRAPH98 Conference Proceedings, 115-122, 1998.

Dr. Yoon's professional service record is good. He is an Associate Editor of the International Journal of Modeling and Simulation (1994-present) and on the editorial board of Computer Aided Design & Application (2005-present). He has been a program committee member for the following three major international conferences for many years: International Conference on Modeling and Simulation (1992-present), Intelligent Systems and Control (1997-present), and IASTED International Conference on Computer Systems and Applications (1998-present). He has been a referee for several major computer journals. So he is getting visibility nationally and internationally.

Dr. Yoon's college and department service is also good. He is constantly involved in the business of College CECS Executive Committee and CIS Graduate Committee (as its Chair), and frequently involved in the business of MSCIS Review Committee (as its Chair). He has been Chair of various other committees of the department and Acting Chair of the department for the past five years. He is obviously a trustworthy and reliable citizen of the department.

Dr. Yoon's recent funding record is not that impressive. Although he is involved in quite a few research projects as Co-PI, he does not have a major grant of his own for the past seven years. But he had grants from Fortune 500 companies such as Ford and Motorola. Grants from those companies are not easy to get, the funding rates sometime could be as low as 5%. Therefore, if these factors are considered, I would say that Dr. Yoon's performance in this area is acceptable.

I don't know much about Dr. Yoon's teaching and I have never attended Dr. Yoon's lectures or presentations, so I am not in a position to make comments on his teaching.

As a senior member of the department, Dr. Yoon's supervising record is not good. However, since I do not know the size and history of CIS Department's Graduate program, I don't think I should make comments on this part either.

In summary, the performance of Dr. Yoon during the past 13 years as an Associate Professor is not outstanding, but is above average, according to my experience as an outside evaluator during the past three years (for the University of Singapore, the University of Missouri - Columbia, the University of Hong Kong and the University of Colorado - Denver). Dr. Yoon deserves to be promoted to a Full Professor in the CIS Department and I support the promotion.

Sincerely,

Fuhua (Frank) Cheng