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To Whom It May Concern:

I enthusiastically support giving the President's Science Award to the core research leaders of the Process Analysis Toolkit (PAT) team: Dr. J.S. Dong (Associate Professor at NUS) and his two former PhD students Dr. J. Sun (Assistant Professor at SUTD) and Dr. Y. Liu (Assistant Professor at NTU). Since my 2007 Turing Award (the Nobel Prize in Computer Science) is for my co-invention of Model Checking (with my former PhD student, A. Emerson, and the French computer scientist, J. Safikis), and since the PAT's research is on Model Checking, I am able to give a very precise evaluation of their achievements. Below I answer the questions in the online form:

(A) Please describe the capacity in which you know the nominee and any affiliation with the institution.

I am aware of the nominees' excellent research. I attended talks and presentations by the nominees and had many fruitful research discussions with them last month in Singapore. I have no affiliation with the institutions except for two weeks as a visiting professorship at NUS in March 2014.

(B) Please comment on the present state of science/technology in the nominee's area of research.

The research done by the nominees is outstanding. It not only generated many top-tier publications (though the number of publications doesn't tell much; 100+ papers in a few years does), but it also has had remarkable impact in high tech companies. It resulted in a unified semantic theory of state, event, time, and probabilities, and in an expressive set of new modelling languages. The advanced software system, developed by the nominees and unlike many research prototypes, is of high industrial quality. As a result, it is no surprise that it has been extensively used in Japanese industry.

(C, pt. 1) Please comment on scientific merits and innovativeness of the nominee's research.

The research done by the nominees is both innovative and extremely important. For its innovative-ness, the research results have been consistently published in top-ranked conferences and journals, which clearly demonstrates that the nominees are advancing the state-of-the-art. In fact, the nominees have developed the only model checker which is capable of verifying a range of very different systems. For its importance, the research has been applied in many organizations and systems, and previously unknown bugs and errors have been identified.

(C, pt. 2) Please also indicate (YES/NO/NEUTRAL) whether the research was original and had addressed important scientific questions.

Yes

(D, pt. 1) Please comment on the impact of the nominee's research /contribution in increasing basic understanding and knowledge of this field of research.

The nominees' research stems from their work on fundamental theories. Some simple examples from their recent work (related to PAT) have contributed to an understanding of the role of time in system verification: (1) in particular, how to deal with Zenoness – a concept from ancient Greek philosophers; (2) the problems caused by non-determinism (i.e., unexpectedness) from a system reliability point of view; (3) whether "partial order reduction" (i.e., a break-through for model checking) has reached its limit or not. Furthermore, their research has had a clear impact on other fields of research as well. For example, the nominees have recently developed a way of finding "optimal" traffic control rules using their research on model checking.

(D, pt. 2) Please also indicate (YES/NO/NEUTRAL) whether the research had increased basic understanding and knowledge of this field, and had advanced knowledge and understanding within its own field and across other fields.

Yes

(E) Please comment on the impact of the applications or potential applications of the nominee's work.

The software toolkit PAT, a result of their research, has already been applied in many industrial companies and systems. Their customers include a number of well-known Japanese companies, as well as companies from USA, China, France, etc. The importance of PAT and similar programs is unarguable. This is evidenced by the fact that model checking is now a routine task for many complex systems.

(F, pt. 1) Please comment on the strategic importance of the research for science & technology development and/or economic development internationally and in Singapore.

Formal methods, and particularly model checking, have important usage in the real-world applications in the area of embedded systems, security, and more recently in biology. Major industries, like Intel, now use model checking to replace testing to prove the total correctness of the integrated circuit they build. Singapore is a vibrant country that has strong industries in embedded systems and biology. The proposed research could potentially help these industries to provide high quality products. On my trip to Singapore I learned cyber-security is currently an important topic that the government wants to address. I believe formal methods will be very useful to help to build reliable and secure systems.

(F, pt 2) Please also indicate (YES/NO/NEUTRAL) whether the research was internationally competitive and had groundbreaking advances in comparison with other similar and prominent work.

Yes

(G, pt. 1) Please comment on the potential development of nominee and his/her research.

During my two-week visit to Singapore, I interacted with the PAT team extensively. I listened to the presentations given by the team and was quite impressed by their achievements. More importantly, I saw their vision for research in this direction and their enthusiasm to advance the model checking techniques. I am certain they will find additional applications in all kinds of interesting directions. Currently, the PAT team is probably the largest formal methods research team in the world. The current level of publications and funding is very robust. With the continued strong leadership, I believe PAT team could produce research results and industrial applications with even greater impact.

(G, pt. 2) Please also indicate (YES/NO/NEUTRAL) whether the nominee(s) has vision, mastery of fundamental techniques and the ability to carry out sustained research.

Yes

(H, pt. 1) Please comment if the research work by the nominee(s) had any fundamental flaws.

No

(H, pt. 2) please also suggest any improvements that can be made to the nominee's research.

No. Maybe they should visit the US to find more opportunities for industrial case studies.

(I, pt. 1) Please provide any information that you deem important for Award consideration.

Model checking is a relatively new methodology that has been increasingly attracting more researchers from diverse areas. I am really impressed by the research done by the PAT team. More importantly, the PAT team is not only contributing theoretical breakthroughs in this area. It is also developing practical tools to translate the state-of-the-art technology into the practical real-world tools that will directly benefit Singapore. In fact, I haven't seen this kind of effort before in the history of model checking. I was very much impressed by the motivation and dedication of the PAT team. I believe this award will recognize their hard work and encourage them to do even more in the future. Moreover, PAT is 100% developed in Singapore. The PAT team has indeed put Singapore on the world map of high tech scientific research.

(I, pt 2) Please also provide an overall score of the research by the nominees.

Exceptionally important

Sincerely,



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Professor of Electrical & Computer Engineering