To Professor Saburou Saitoh on the occasion of his 70th birthday

Professor Saburou Saitoh celebrated his 70th birthday at the Center for Research and Development in Mathematics and Applications (CIDMA), hosted by the University of Aveiro, Portugal, where for the last five years, as a Researcher within CIDMA (supported by the Portuguese Foundation for Science and Technology - FCT), he had a significant far beyond mathematics.

Professor Saburou Saitoh was born at Tochigi Prefecture, Japan on March 4th, 1944. He completed the undergraduate courses at Gunma University and the postgraduate courses of Master and Ph.D. at Tokyo Institute of Technology. He got academic positions at Shibaura Institute of Technology (1971-1976) and Gunma University (1976-2009). He was appointed as Emeritus Professor of Gunma University in 2009. After that, he got a five years Researcher Position at CIDMA, University of Aveiro (2009-2014).

The Ph.D. thesis of Professor Saitoh had the title “The Bergman norm and the Szegő norm”, and these topics held a substantial influence on his future research. At that time, he was already exchanging ideas with colleagues from all over the world. Namely, he visited the United States of America for research in the University of California, Stanford University, University of Pittsburgh and University of Delaware, in the period 1986-1987, supported by the Japanese Government.

He has been participating in the ISAAC congresses since the very first congress at the University of Delaware, in 1997, and all this time he has been organizing sessions related with reproducing kernels. Associated with this, he published two volumes of the Proceedings from Kluwer Academic Publishers with the related leading mathematicians. Moreover, he was the Vice-President of ISAAC for six years.

Professor Saitoh is a very special mathematician that allows his own research to be driven by his great personality. His concern about integrating mathematics in the spirit and motivations of life and the human being is an example for the younger ones. On the top of his present concerns, we can find the search for the purpose of our life and the interpretation of what mathematics is. This is performed by Professor Saitoh in a rather wide spectrum, where the relation between mathematics and the global laws of the universe are constantly on his mind. Within this scope, the general emails sent by Professor Saitoh are well-known to some of us, and not so well understood.
by a few others. The point is that Professor Saitoh is always trying to think above the human nature, and this leads to the case that more often than not, when he is writing about one specific topic, he is in fact already considering a somehow future possibility, of a more global nature, than that of the original specific problem. Not rarely, Professor Saitoh is even trying to implement or generalize very general rules, even in the mathematics field, such as the Pythagoras theorem. His research group is not so large and its main theme is concentrated in some restricted nature on the theory of reproducing kernels. This, however, does not make it impossible for Professor Saitoh to develop applications in several different fields of mathematics by using the theory of reproducing kernels. Indeed, his dedication to reproducing kernels is without doubt very deep.

Professor Saitoh’s main rule about research on mathematics is that it should be fundamental, beautiful, and produce a significant impact on human beings. This spirit had led Professor Saitoh to several fundamental results on the theory of linear transforms, Pythagorean theorems, several very general norm inequalities, representations of non-linear simultaneous equations and implicit functions, different types of applications of the Tikhonov regularization (including a typical main result on a numerical and real inversion formula of the Laplace transform, with the coauthors Professors Hiroshi Fujiwara and Tutomu Matsuua).

The last five years that Professor Saitoh spent at University of Aveiro were very fruitful in his research: he had the opportunity to introduce his great ideas and methods on reproduction kernels to the research group in Aveiro and he also kept himself open to the research interests of the Aveiro group members. This turned out to generate some relevant development in the areas of Integral Equations, Differential Equations and Operator Theory. Moreover, during this period, he had the chance to realize one of his plans outside the research on mathematics: Together with his son, he published an essay book on the universal problems beyond mathematics.

On mathematics, besides other subjects, he published the so-called “Aveiro discretization method in mathematics”, with the colleagues L.P. Castro, H. Fujiwara, M.M. Rodrigues and Vu Kim Tuan. This is basically a very general discretization method, by applying the theory of reproducing kernels, which allows significant numerical experiments. In particular, with this method, it is possible to solve very general linear PDEs satisfying global boundary conditions and initial values (somehow independently of the type of boundary and domains). Furthermore, Professor Saitoh was able to clearly give an ultimate sampling theory and realizations of general reproducing kernel Hilbert spaces.

In Professor Saitoh’s papers of the past five years one can find this general theory in a self-contained manner, with some related history and many concrete examples. As an example, we can point out a developed method which, roughly speaking, when
we know some eigenfunctions of a linear operator, we can consider the related partial
differential equation and solve an associated initial value problem. In this method,
we shall consider the reproducing kernel forms and related integral transforms (linear
mappings), it being therefore possible to discuss the corresponding existence and
construction problems of the initial value problem. Furthermore, it is possible to
consider the complete properties of the corresponding solutions by using the theory
of reproducing kernels. From this general method, we are capable of analysing in
detail many integral transforms and reproducing kernels in concrete forms from the
known eigenfunctions.

Professor Saitoh published, with his collaborators, over 150 papers and 7 books
(indexed in the new zbMATH interface). Moreover, together with Professor Yoshi-
hiro Sawano, he is planning to publish in Springer a fundamental monograph entitled
“Theory of Reproducing Kernels and Applications”.

As a tribute to his involvement in the life and activities of CIDMA, for his
research activities, and also for his attitude concerning the Romanian school of
mathematics and the journal Libertas Mathematica, it is our honour to dedicate to
Professor Saitoh this issue of the journal.

Vasile Staicu
Editor in Chief of LM(n.s.)

Luís F. P. Castro
Director of CIDMA