# A Tribute to Frank Callier

Joseph J. Winkin

University of Namur
Department of Mathematics and Namur Institute for Complex Systems
Rue de Bruxelles 61; B-5000 Namur, Belgium
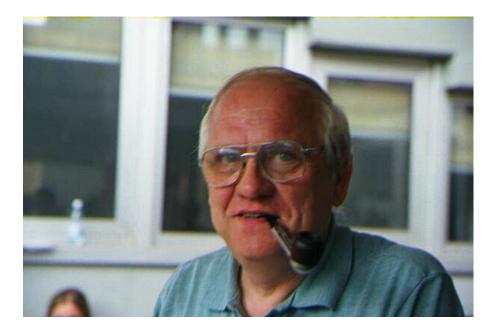joseph.winkin@unamur.be

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The aim of this brief text is, on behalf of all the members of the "System and Control Community", and especially those of the "Distributed Parameter Systems community", to thank Frank Maria Callier for all he did and is still doing for our scientific community, in Belgium and all over the world. We all know his modesty and humility; nevertheless we are sincerely convinced that he deserves such a tribute.

If you ask me to describe Frank in one word, I would say: *scholar*, i.e. a person who is highly educated and has an aptitude for study. This term also describes a person who studies a subject in great detail, especially at a university. This is the word which can describe him best. In addition, Frank is a wise man; this assertion is very well illustrated by one of his favorite mottoes: " Beter een vogel in de hand dan tien in de lucht " . He has always focused his research activities on fundamental questions in system and control theory, without studying too many different problems at the same time, and always with the same simple goal: understanding in depth.

When speaking to Frank, you quickly notice that there is a word, which comes quite often out of his mouth: Berkeley. He spent several years at the University of California, in Berkeley, where he got his Ph.D., in engineering and computer science in 1972. Charles Desoer was his thesis advisor. At that time he was already involved in the study of Distributed Parameter Systems (DPS): he extended the well-known Nyquist stability criterion to such systems.
In 1979, he received an Honorable Mention Paper Award of the IEEE Control Systems Society (Institution of Electrical and Electronics Engineers, New York), jointly with Wan Chan and Charles A. Desoer, [3].

One of the most outstanding contributions of Frank, if not the most outstanding and famous one, is certainly the invention and the development of what is commonly called the Callier-Desoer algebra of transfer functions for DPS (1978), [4], [5] [6].
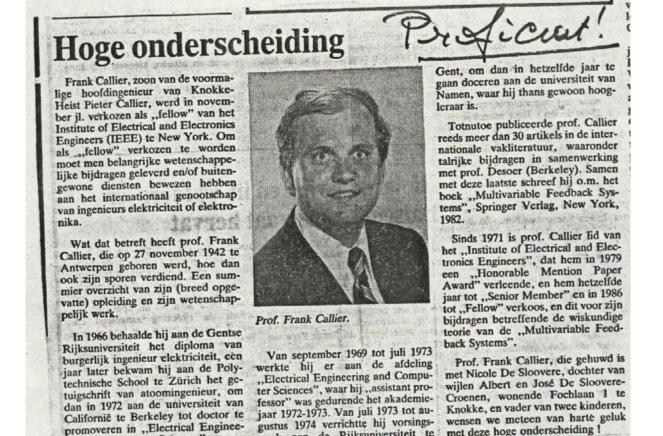
This is by now the standard class of transfer functions which people usually work with in DPS theory, [13], [10]. This class can be seen as a subclass of H-infinity, which encompasses all DPS of interest in applications. At least, as far as I know, nothing better has been found so far.

You may also know that Frank is one of the first contributors to the factorization approach (he prefers to use the word: fraction) for feedback control system synthesis, [15]. He established the parameterization of all stabilizing controllers for DPS in a paper published in the *Annales de la Société Scientifique de Bruxelles*, [6], at the beginning of the 80's, some short time before the publication of the famous (general paper) by Desoer, Liu, Murray and Sacks.

Frank is also an expert in spectral factorization and Riccati equations. He published several fundamental papers on these topics, in particular with Jacques Willems (on the convergence of the Riccati differential equation), [12], and with myself, [11], [16]. Frank is really a fan of spectral factorization. One of his most important contributions is certainly the paper on the spectral factorization problem of polynomial matrices, where he played one of his favorite games: the massage of the point at infinity, [1].

He also wrote two books, both jointly with Charles Desoer: a research monograph on the polynomial approach to multivariable feedback systems, [7], and a textbook on linear system theory, [8]. These books may appear to be hard to read, when reading them superficially. However, if you look at the details, you will easily observe that they are extremely carefully written and they contain numerous fundamental and solid concepts and results. These books have been cited a numerous amount of times in the literature and the second one has been used as a textbook reference for several university courses, especially in the US.

Frank has also been elected fellow of the IEEE for his contributions to multivariable feedback system theory. This was made known all over our country, by articles published in Belgian newspapers.

Frank did not directly supervise many doctoral thesis. However he had very important and strong influences on a lot of young people, notably as an active member of a good number of doctoral thesis committees.
His outstanding work as reviewer of numerous papers, and as Associate Editor of *Systems and Control Letters*, *Automatica*, and *IEEE Transactions on Automatic Control* , and as Associate Editor at Large of the latter, was and is still highly appreciated by all his colleagues.

He is very exacting, for others, but first for himself. When working on a specific research topic and when writing papers with him, you will quickly observe that he is hard to please and that he does not like at all to rush for publication. Instead he prefers to take the time to analyze again and again all the facets of the same question in depth, he prefers to write and rewrite a part of a paper (or a whole paper), until he reaches a final result which pleases him and which he believes will

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be not too far from the final result after review.

When he reads a paper, he really does it in detail. He does even more: he rewrites the whole paper for himself, even by rediscovering the proofs contained in the paper, without reading them in advance. He is really impressive.

Frank likes teaching very much. As a professor, he has educated numerous students in mathematics, notably by giving fundamental courses of mathematical analysis, viz. topology, and measure and integration (including Fourier transform), introductory courses of optimal control and optimal feedback systems, and a master course on semigroup theory, [2].

He is known by several of us and by his students in Namur, as being a citation specialist. To be more precise, he likes to state, especially when he is teaching, some short sentences, which translates in a very pictorial way his goal or his feelings at a particular specific time of a course. This happens for example when he introduces a new concept or notation, or when he explains a proof of a theorem.

Frank has often told me that he does not want to be seen as a piece of museum. Of course he is not: he has been and is still active, as it can be seen on his personal home page *https://researchportal.unamur.be/fr/persons/frank-callier*. This is also confirmed by his recent contributions, [9], [14], where one can observe once more his extreme care in writing scientific papers, and his excellent abilities as engineer and applied mathematician.

I wish to address to him again my sincere thanks and those of all my colleagues, for all he has done, and also for what he is still presently doing. Good luck to him and his family for all his future projects and activities.

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