

Professor Emeritus Alessandro BIROLINI - A Guru of European Reliability

During the six decades of relatively short history of reliability, a number of top professionals marked the evolution of this important interdisciplinary field.

Among the European specialists who brought remarkable contributions to the development of this domain, the name of Prof. Dr. **Alessandro Birolini** from the Swiss Federal Institute of Technology Zürich is a prominent one.



Prof. Em. **Alessandro BIROLINI**

Alessandro Birolini was born on the 13th September 1940 in Lugano, Switzerland and is presently **Professor Emeritus of Reliability Engineering** at ETH Zürich.

It is important to mention that the **Swiss Federal Institute of Technology (ETH) Zürich** is itself a pole of excellence in science and technology and is ranked among the top universities in the world (being classified as the 3rd in Europe, after the universities of Cambridge and Oxford).

After his Dipl. Ing. HTL, Dipl. El.-Ing. ETH, Ph.D. (ETH), and 15 years of industrial experience (of which 4 years in charge of setting up the **Swiss Test Laboratory** for VLSI ICs in Neuchâtel), Dr. **Alessandro Birolini** was from 1986 to 1998 Professor and head of the Reliability Laboratory at the ETH Zürich (Full Professor since 1992).

His research interests included fault tolerant systems with hardware and software, stochastic processes for reliability theory, test & screening strategies, and failure mechanisms.

Prof. **Birolini** has also been involved in an effective cooperation with 30 large and medium industries for over 10 years. He is author of more than 40 research & tutorial papers as well as of several monographs and books, among which the habilitation thesis *On the Use of Stochastic Processes in Modeling Reliability Problems* (Springer 1985) and the book *Reliability Engineering: Theory and Practice* (Springer, 6th Ed. 2010, 1st Ed. 1994, 1st German Ed. 1985, 4th German Ed. 1997).

Achievements include a new approach to compute the transition probabilities for Markov, semi-Markov & semi-regenerative processes and the development of approximate expressions for the reliability and availability of complex fault tolerant systems.

During more than three decades **Alessandro Birolini** brought an important contribution to the development of reliability, to its recognition as important domain of interest in the engineering and academic fields, not only in Switzerland but in the entire Europe. The international cooperation developed by Professor **Birolini** as Director of the Reliability Laboratory from ETH Zürich, the important number of international conferences and symposia in the field organized by Professor **Birolini** in his laboratory in Zürich (which became a veritable European pole of excellence in its field) entitle the opinion of several international experts in the field to consider Professor **Birolini** as a veritable **Guru of European Reliability**.

Engineer and philosopher (or “*Ingenieur et penseur*” - as he defined himself on the cover of his remarkable book *Reliability Engineering: Theory and Practice*), Professor **Birolini** brought an important contribution to the development of theory and practice of reliability, to its recognizing as an university domain of education and research.

I had the opportunity to work, for a short period in 1994 as an Invited Professor at the Reliability Laboratory of the Swiss Federal Institute of Technology (ETH) Zürich, when I presented a short course on “*Dependability of Complex Systems*”. I had the extraordinary opportunity to work during this period with Sandro Birolini and I was impressed not only by his professional stature, but also by his human stature. Indeed, Professor **Birolini** is not only an excellent manager and specialist in Reliability field, but a man of an exceptional integrity, kindness and modesty.

Several honors gather to crown his exceptional career: **Alessandro Birolini** is a Life Member of the Swiss Academy of Engineering Sciences, Honorary Member of the Romanian Academy of Sciences, Life Senior Member of the IEEE, Recipient of the IEEE Third Millennium Medal. Professor Birolini was President of the Swiss Information Technology Society and Chairman of the IEEE Switzerland Section as well as Founder and Chairman of the IEEE Switzerland Reliability Chapter a.o.

The special session organized during the 12th *International Conference on Quality and Dependability - CCF2010* in the honor of Professor Emeritus **Alessandro Birolini** represents the homage of the specialists in the field for a remarkable specialist and man.

The participants at CCF2010 will have the special opportunity to meet Professor **Alessandro Birolini**, who will present a conference concerning “*Approximate Expressions for the Reliability and Availability of Repairable Large Systems*”, and will launch the 6th edition of his monumental book *Reliability Engineering: Theory and Practice* (published by Springer Verlag in September 2010).

At the anniversary of seven decades of his exceptional life and career, we wish Professor Birolini a long and fruitful life, with many achievements in the field to which he devoted himself: RELIABILITY.

Happy Anniversary, Sandro!

Professor **Ioan C. BACIVAROV**, PhD
Director of EUROQUALROM Laboratory
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Lessons from a Life Dedicated to Reliability

An Interview with Professor Emeritus Alessandro Birolini

The honorary guest of the 12th International Conference on Quality and Dependability – CCF2010 was Professor Emeritus Dr. Alessandro Birolini from the Swiss Federal Institute of Technology (ETH) Zürich, considered as a „Guru“ of European Reliability. Engineer and philosopher („Ingenieur et penseur“), as he defined himself, Professor Alessandro Birolini brought an important contribution to the development of theory and practice of reliability, to its recognizing as an university domain of education and research. His career and life constitute a real example, especially for the young researchers in the field. With the occasion of CCF2010, Prof. Birolini gives us this interview regarding some interesting aspects of his professional and personal life.

Ioan C. BACIVAROV

Ioan Bacivarov: Referring to your speech at the celebration of your 70th anniversary and the launching of the 6th English edition of your book *Reliability Engineering* (Springer-Verlag) at the CCF2010 in Sinaia, I would like to go deeper in your professional and somewhat also personal life. You were born in the Italian part of Switzerland, which makes only something more than 5% of the Swiss population, how large was the influence of this **membership to a small minority** on your formation, professional and human?

Alessandro Birolini: Switzerland is a very old confederation, started 1291 with a pact between three small countries just at the north side of the Gottardo pass and extended step by step to form 1815 the today Switzerland. Based on this long tradition, minorities are respected and more than this well accepted, when integrated. Switzerland is a confederation of republics with large autonomies, a typical example as Europe should be. So, with Italian mother language in Switzerland we must accept to be a minority and to move toward the French or German majority, beginning by learning the language, to have greater formation and/or professional opportunities. It must be noted that learning, and accepting, another language and culture is an enrichment.

Ioan Bacivarov: So you must **move from home** to continue your formation?

Alessandro Birolini: Yes, it was the only possibility.

Ioan Bacivarov: Which were then the **main steps** in your formation and in your professional life?

Alessandro Birolini: Coming from a family with limited financial resources, the only possibility was to start learning a job which would allow me to work during the study. Here the main steps in my formation and professional life:

- After an apprenticeship as an electrician, a Bachelor's degree at the Technicum Cantonal de Fribourg (near Bern) and a Master's degree in electrical engineering at the Swiss Federal Institute of Technology (ETH Zurich), I was a research assistant at the ETH to achieve the **Ph.D. degree** in 1974.
- Following 5 years as Senior Engineer at Contraves Zurich (working on a product assurance concept with training of middle management and project heads) and 5 years in Neuchâtel to create the Swiss Test. Lab. for VLSI devices (a 8 MSFr. Swiss Gov. Project), I submit 1985 my **Habilitation Thesis** *On the Use of Stochastic Processes in Modeling Reliability Problems* (Springer-Verlag, Lecture Notes in Ec. & Math. Syst.) and the



Prof. Emeritus Dr. Alessandro Birolini together with Prof. Dr. Ioan C. Bacivarov, Chairman of the International Scientific Committee of CCF2010 at the launching of the book „Reliability Engineering“

1st Ed. of the book *Qualität und Zuverlässigkeit technischer Systeme* (Springer).

- Starting 1986, I was **Professor for Reliability Engineering** at the ETH Zurich up to my retirement. Important at the ETH was an effective cooperation during more than 10 years with 30 large and medium industries in Europe on the basic rule of 20.000 SFr. per year and company to purchase large equipment & support research projects with 20 engineers and physicists, of which 8 Ph.D. candidates, and 8MSFr equipment (see *Quality Eng.* 8(1996)4, pp. 659-674).
- In 1994 the 1st Ed. of the book *Reliability Engineering* and in 1997 the 4th and last Ed. for the book *Qualität und Zuverlässigkeit technischer Systeme* were published by Springer.

Ioan Bacivarov: The **begin of your activities** in the reliability field goes thus back to your Ph.D. thesis?

Alessandro Birolini: Yes, my first contact with reliability engineering goes back 40 years with an expertise on a large air defense system for the Swiss army, delivered 1970 by Hughes. This was followed by a

Ph.D. thesis (ETH 5375, 1974) dealing with a new generator for stochastic processes based on the concept of failure rate (*Math. & Comp. in Simul.*, 19(1977) pp. 75-97 & 183-191), and the extension of the investigation of the 1-out-of-2 redundancy to the case in which the involved stochastic process has just one regeneration state over 5 states (*IEEE Trans. Rel.* 24(1975)5 pp. 336-340).

Ioan Bacivarov: **Creativity** is thus necessary to reach high targets in any project or activity, what is your concrete opinion on this point?

Alessandro Birolini: Creativity is generally defined as the *capacity to create and invent with free fantasy*, for engineer and scientists it can also be expressed as *capacity to give new, better solutions to known or emerging problems*. Creativity can not be deployed on command. It can be stimulated by an internal conviction/confidence, a deep observation of and reflection on the nature around us, and often also a reaction to an adversity. In any case, a predisposition and a favorable environment are necessary to develop and support it. However, creativity can be deemed by de motivation, excessive depersonalization or excessive bureaucracy. Bureaucracy and the often related corruption are the worse sores that bother many states.

Ioan Bacivarov: To the future, which should be in your opinion the **future of reliability engineering**, in research and development?

Alessandro Birolini: In order also to support a sustainable development, a basic course on reliability engineering should belong to the curriculum of almost all engineering degrees (as stated 2003 in the preface to the 4th edition of my book). With respect to research, a part the reliability aspects in all technological development (lead-free soldering at assembly level and nano technology at devices level, just to give two examples), that must be solved together with specialists working in the corresponding fields, improvement in remote diagnostic and maintenance, as well as further research on modeling systems with hardware and software, distributed structures (e. g. networks), imperfect switching, incomplete coverage, common cause failures, elements with more than two states are necessary, also here just to give some important areas.

Ioan Bacivarov: Finally, how do you explain the **success key** for your book *Reliability Engineering*, reaching now the 10th edition by summing over the 4 German and 6 English editions (1st Ed. 1985 and 1994, respectively), distributed over 25 years?

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Alessandro Birolini: Besides the more than 15 years experience in the industry, and a predisposition to be a self-taught man, my attitude to life was surely an important key for the success of my book. This is best expressed in the 3 sentences given on the 1st page of my book in the three last editions:

- The first sentence is from Louis Pasteur (about 1850) and says:

„La chance vient à l'esprit qui est prêt à la recevoir“

something like: „Opportunity comes to the intellect which is ready to receive it“

- The second sentence is from Louis De Broglie (about 1930) and says:

„Quand on aperçoit combien la somme de nos ignorances dépasse celle de nos connaissances, on se sent peu porté à conclure trop vite“

something like: „When one recognizes how much the sum of our ignorance exceeds that of our knowledge, one is less ready to draw rapid conclusions“

- The third sentence is from me and says:

„One has to learn to consider causes rather than symptoms of undesirable events and avoid hypocritical attitudes“

These three sentences, insisting on **generosity**, **modesty** and **responsibility** apply quite general to a wide class of situations and people, from engineers to politicians, and it is to hope that the third sentence, in particular, will be considered by a growing number of humans, now, in front of the ecological problems we are faced and in front of the necessity to create a federal world wide confederation of democratic states in which freedom is primarily respect for the other. There are some few other suggestive sentences in my book, for example that saying „it would seem to be opportune to



Prof. Emeritus Dr. Alessandro Birolini together with Dr. Dan G. Stoichitoiu, General Chairman of CCF2010

unify models and data, taking from each model the „good part“ and putting them together for „better“ models (strategy of wide applicability)“. All these sentences, added to a great willingness and perseverance, express a life attitude which was surely important for the success of my book **Reliability Engineering**.

Ioan Bacivarov: Thank you Sandro for this interview. At the anniversary of seven decades of an exemplary life and a long and fruitful scientific career, I wish you –in the name of the specialists in this domain a long and fruitful life, with many achievements in the field to which you devoted yourself – the **reliability**.

Asigurarea Calității – Quality Assurance este unica revistă din România care abordează problematica **ingineriei** și **managementului calității** din perspectiva tuturor componentelor acesteia: **conformitate** și **siguranță în funcționare** (fiabilitate, mentenabilitate, securitate etc.), ceea ce o face indispensabilă companiilor care vor să fie la curent cu abordările moderne în acest domeniu interdisciplinar actual și important. Apare trimestrial în 32 de pagini și publică articole în limbile engleză și română în domeniile menționate anterior, fiind distribuită și în străinătate. Este acreditată de către CNCSIS și inclusă în baze de date internaționale.

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