

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?

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**.

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