

## FROM SWISS TO TECIS AND BEYOND

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*Abstract:* The IFAC TC 9.5 “Supplemental Ways for Improving International Stability – SWIIS” was one of the longest IFAC communities dating back to the 1981 World Congress in Kyoto. In 1983 Austria hosted the first IFAC SWIIS Workshop attracting a unique range of inter-disciplinary contributions. SWIIS expanded into an IFAC Technical Committee (TC 9.5) as a bridge between control scientists and automation engineers and various other disciplines with the common theme of improving human living conditions and explore contributions to a stable and sustainable planet. Whilst the “heartbeat” of TC 9.5 has remained, the scope has expanded as the TC grew and developed, and the world changed to the present status and perspective.

This contribution starts with a short history of SWIIS and because of the changing scope the transformation to TECIS in 2011. This was necessary for including new actual topics.

Finally an outlook in the future, emphasising new topics, will be given in this paper.

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### 1. INTRODUCTION

The initial idea to install an IFAC Working Group on the topics of “Supplemental Ways for Improving International Stability” arose in 1981 during the IFAC World Congress in Kyoto. These discussion were formally initiated and encouraged by Harold Chestnut, former president of IFAC. These were concerned especially with the obvious potential prospect of an international system which could descend into the chaos of nuclear conflict. In turn, the appropriate decision of IFAC to undertake and lead this delicate and highly interdisciplinary exploratory adventure yielded the decision to start scientific investigative activities along these lines. Thus the working group organisally developed into a more formal organizational body in the foirm of a technical committee within IFAC in the years to come and up to the present days (Kopacek, 2008; Stapleton and Kopacek, 2011).

### 2. BRIEF HISTORY

#### *1983 Laxenburg*

The installation of an IFAC Working Group on “Supplemental Ways for Improving International Stability” arose in 1981 during the IFAC World Congress in Kyoto and was initiated by Hal Chestnut. As a result the first IFAC

SWIIS Workshop was held in Laxenburg, Austria, Sept. 13 – 15, 1983. It has greatly benefited from some of the international and interdisciplinary co-operations that were suggested in several of the presentations and discussions during the workshop.

#### *1986 Cleveland*

The Second Workshop of the IFAC Working Group on SWIIS took place in Cleveland, Ohio, USA June 3-5, 1986. This workshop considered a most important question of at that time for all humanity: how can nations function without the need to go to war to settle international disputes?

#### *1989 Budapest*

In 1989 the IFAC/SWIIS workshop, International Conflict Resolution using Systems Engineering, was organised by the Computer and Automation Institute of the Hungarian Academy of Sciences in co-operation with the Austrian IFAC NMO. This theme thus continued a focus on the interrelationship between technology and conflict resolution that had been established at the previous workshop held in Cleveland USA in 1986.

### 1992 Bolton

One of the most important activities in our historical development was the SWIIS' 92 Workshop. It was held in Bolton (Toronto, Canada) during September 21-24, 1992 and was organised by "Science for Peace" on behalf of Canadian National Committee for IFAC. The program of SWIIS'92 contained over 20 technical papers from eight different countries (Kopacek et.al, 1992). The changes affecting the SWIIS Working Group that arose from the 1993 Congress in Sydney presented a useful and welcome opportunity to further structure and focus the SWIIS activities for the coming years.

While the indicated and probable elevation from WG to Technical Committee status was mainly part of a general IFAC restructuring taking place at that time, the modified scope suggested opportunities for new activities and possible changes in direction for SWIIS and its members.

### 1995 Vienna

The IFAC event on „Supplementary Ways for Improving International Stability“ - SWIIS'95 - was held in Vienna, Austria from September 29 to October 1, 1995. This fifth event in the SWIIS series was organised by the Institute for Handling Devices and Robotics of Vienna University of Technology. Meanwhile the working group SWIIS was a Technical Committee (TC 9.5) in IFAC and the triennial workshops were appointed as regular IFAC conferences.

The conference continued the tradition set in the earlier four SWIIS meetings. The goal was the beneficial application of systems engineering methods onto description of conditions, in which nations or groups interact with one another. Scientists from other fields such as political science, economics, social science, and international studies should have a platform to present and discuss their ideas. Perhaps, this SWIIS event differed from earlier SWIIS meetings in the efforts to attract a younger generation to the work in the framework of this TC.

Organised by the Technical Committee, a SWIIS session entitled „Supplemental Ways for Improving International Stability“ was scheduled by the organisers of the IFAC World Congress in San Francisco, 1996. All five presented papers gave an excellent survey of the scope of this IFAC TC.

### 1998 Sinaia

According to the SWIIS TC meeting in San Francisco 1996 the 7th SWIIS conference was held in May 14-16, 1998 in Sinaia, Romania. At the IFAC World Congress 1999 in Beijing the TC SWIIS was responsible for the organisation of two technical sessions. Both had with approximately 40 a very high attendance. The trend, inclusion of more economical and historical topics, started at the two last SWIIS events in Vienna and Sinaia was continued. Examples were the presentations from Dimirovski and from the Institute of the University of Klagenfurt. Starkermann gave

very exciting speeches on application of multivariable systems theory to conflict situations. At the TC meeting it was decided to have an intermediate SWIIS workshop in Macedonia. One of the reasons was the actual political situation in this region. Therefore we had, at the first time in the SWIIS history, contributions of colleagues from Macedonia. This Workshop was very successful and on the TC meeting it was decided to co-operate closer with the the IFAC TC's on “ Social Effects of Automation” and “ Developing countries”. As a first result of this decision SWIIS was responsible for the organisation of two invited sessions on the DECOM (former TC 9.3) event 2001 also in Macedonia (Kopacek, 2000).

### 2001 Vienna

The next IFAC Conference was organised in Vienna in 2001 attended by colleagues from SOCEFF and DECOM as well as a large number of scientists from Russia. At the IFAC World Congress 2002 in Barcelona SWIIS was responsible for the organisation of an invited session. At the TC meeting it was decided to have the next SWIIS conference in Waterford (Ireland) in 2003 and a “Multitrack Conference” in September 2004 in Vienna involving a number of related TCs.

### 2003 Waterford

In the difficult times of the early 2000s the work of SWIIS was more important than ever. SWIIS 2003 in Ireland gathered together researchers from many countries interested in understanding how technology could be used to benefit people across the globe. In this conference a series of papers with a unique variety of perspectives and insights were presented. Issues as varied as globalisation, education, unemployment and economic systems were all covered in the event with a wide range of experts coming together to explore and investigate issues relevant for humanity. During the conference predictions were made concerning climate and the impact of migration and the importance of control science as a way of modeling these effects. This work was further developed and presented by the then chair of TC 9.5, Fred Kile, at the 2005 IFAC world Congress. Now, over ten years later, these models and their predictions have proven correct (Kile, 2005). There were also two special sessions. One of these dealt with the pressing need to revitalise the debate on engineering ethics, raising questions and providing new insights into how ethical issues can and must be addressed in a ‘global village’ and in the context of the geo-political structures of the twenty-first century. This was driven by the working group on Engineering Ethics in TC 9.5 chaired by Marion Hersh (e.g. of contribution is Hersh & Stapleton (2003)). The second special session brought together a series of scientific contributions from the Russian Federation. It was over ten years since the fall of communism in Russia and this session presented unique perspectives from across the spectrum of contemporary Russian intellectual activity in engineering and systems science (Kopacek, 2003).

#### 2004 Vienna

During this time the highly successful multi-trak conference ACS 2004, an initiative spearheaded from TC 9.5, was held in Vienna and included contributions from CC9 and CC5 academics and practitioners. In 2005 SWIIS (TC 9.5) organized two more special sessions at the world congress in Prague, including a major session on Control Engineering Ethics, organized by L.Stapleton and M. Hersh, and the former chair of TC 9.2, Dietrich Brandt.

#### 2006 Prishtina

The scope of this IFAC SWIIS Conference was to offer insights into unwanted side effects of rapid development and to share methodologies for appropriate ways of managing the introduction of technologies which will alter social stability. The contributions necessarily covered a very broad field of interest and offered deep insights into social aspects of technology transfer, managing the introduction of technological change, engineering ethics, technology and environmental stability, and anticipated secondary and tertiary effects of technological proliferation (Kopacek, 2008).

#### 2009 Bucharest

According to the triennial cycle after Prishtina (Kosovo) 2006 the Conference was organised by the Faculty of "Control and Computers" of the "University Politehnica of Bucharest" from October 28 to 30, 2009 in Bucharest, Romania. The program included 3 plenary papers, 18 technical papers and 2 panel discussions. The plenary papers dealt with a new approach for simulation of sociotechnical systems, international stability issues and globalisation, Co-operative security systems - closed-loop adaptive control. According to the scope of SWIIS the topics of the technical papers were heterogenous. One block of papers dealt with complex - adaptive - systems. Such systems are more and more introduced not only for modelling and control of socioeconomic systems. Another session was about software piracy, existing laws and the impact to economy. Cooperative networks offer the possibility to design an umbrella for different applications. Further topics addressed were fuzzy methods, ethics in IT, collaborative software platforms. In the panel discussion " Impact of the crisis on Social Stability" it was mentioned that in terms of SWIIS the problem could be seen as a stability problem of a very complex system. To solve this problem new theoretical approaches are necessary.

#### 2010 Prishtina

This intermediate event took place at the "University for Business and Technology - UBT" from October 27 - 29, 2010 organised from this University in cooperation with Vienna University of Technology.

The 3 plenary papers dealt with a new approach for simulation of sociotechnical systems, International stability issues and globalisation, ethical issues, students for the future, modelling and control of socioeconomic systems.

The main focus of the 23 technical papers were on the state of the art and further developments in Kosovo. Topics from Sustainable Development, Management in the Service of Stability to Energy, Transportation and Engineering Management were covered ( Stapleton and Kopacek, 2011).

#### 2012 Waterford

Papers on systems processes, especially systems management processes, which are validated at some level (empirically, or through case work) to improve situations in unstable regions were presented. For example, policy and systems management frameworks for improving the implementation and application of supply chain automation in enterprise networks which have proven to increase effectiveness of economic actors in regions of low stability were showcased. Country case studies which compared social system effects (such as socio-technical issues) across regions were also included as they both highlight ethical and governance considerations of interest to a control and automation audience and preferred market opportunities for ethical engineering solutions, demonstrating that ethical engineering is also commercially successful engineering.

#### 2013 Prishtina

During the recent years social international and national systems of control has been shown to be inadequate and prone to be fundamental and most basic instability. Many basic assumptions were no longer certain and are definitely questioned. The main goal of the 2013 TECIS Conference was to systematically examine these topics. Another goal was to propose new approaches in dealing with globalization effects, and investigating international system complexity and the management of knowledge in that context.

Therefore the 48 contributions, 2 Survey papers and 9 papers in 2 Invited sessions presented, covered a very broad field of interest for those subjects like social aspects of technology transfer, globalisation impact of International Stability, control education and International Stability, knowledge management, complex adaptive systems, technology and environmental stability and End of life Management (EoL).

The Balkans were amongst the poorest regions in the European periphery and although there existed a number of important and very active IFAC NMOs in the Balkans, it had proven be difficult for scientists and engineers to find the means by which to present important results at an international IFAC event.



This 2013 conference offered scientists from Kosovo, Albania and across the Balkan region generally the chance to present their research results to an international audience. The TC was also mindful of the opportunity to expand the IFAC family across new countries. Several years earlier the TC had been responsible for drawing a new NMO into IFAC at the Milan WC. This event provided the seed for other new NMO discussions.

### 2015

TECIS 2015 was particularly concerned with the role of Cost Oriented Automation (COA) as a way of improving international stability, through its applications, technologies, processes and as part of larger systems contexts.

With the current new technological developments and emerging trends the importance of the cost-oriented automation has increased significantly and may have a lasting impact on the society and international stability.

After a sequence of successful symposia on "Low Cost Automation" (1986 - 2004) and on "Cost-Oriented Automation" or "Affordable Automation Systems" (2007 - 2010), as well as the Multitrack conference ACS 2004 which had included important contributions in cost-oriented automation, this conference provided an opportunity for specialists in this field to discuss new methods for reducing the costs of automation systems. These approaches and methods considered not only the development and application of low cost components of control systems, but the control aspects of their life cycle including design, production, operating, maintenance, reconfiguration and recycling. The panel discussion "Control Engineering and International Stability" was very successful. As a result a new Working Group was established which contribute the previous work of IFAC in Cost Oriented Control and Automation Engineering, chaired by Professor Peter Kopacek of Vienna.

### Durres 2016

Technology development leads to dramatic changes in international stability. It has never been so important to examine system stability. Currently and during the recent years social international and national systems of control have been shown to be inadequate and prone to be fundamental and most basic instable. Many basic assumptions are no longer certain and are definitely questioned. This event systematically examined these topics. Another goal of the TECIS conference was to propose new approaches in dealing with globalization effects, as studying complexity and knowledge management. Amongst a number of important developments at this event, was the initiation of formal discussion to create a new NMO in the Balkan region, and the establishment of a new forum/working group for young IFAC members to share their ideas and develop their work.

## 3. TOPICS

To illustrate the movement from SWIIS to TECIS serves Table 1. In this table selected Key words and/ or session titles from selected events mentioned above are listed. The grey rectangles means this topic was included in the scope of this event or sessions were scheduled. It should be taken into account that the keywords and subjects were sometimes influenced by the organizers and therefore some of these "falling stars" were omitted. Because of the limited space some keywords have to be merged.

Table 1 shows clearly that in the years between 1983 (83) to 2016 (16) the subjects move from more or less "technophilosophical" to actual "technological" subjects. Exceptions are "Modeling of Stability", and "Application of Control Principles to International Stability" the two original topics of this TC. Furthermore Table 1 shows five remarkable milestones in the history of this TC

1. Waterford 2003 with the introduction of 4 new topics especially " Technological and Social Changes" and "Engineering Ethics".
2. 2006 Prishtina " End of Life Management -EoL".
3. 2010 (Prishtina) with new technological subjects like "CIM and Robotics", "Mechatronic Systems" and "Environmental Systems" continued 2015 ( Sozopol) and 2016 Durres.
4. The new topics of Sozopol (2015) were "Production 4.0" oriented e.g. "Intelligent Machinery", "Software Tools and "Decision Support Systems".
5. In Durres (2016) the trend of Sozopol continued with "Intelligent Systems and Applications".

These represent clear moves to engage direct with real and pressing challenges faced by the international system by using the robust and rigorous approaches, which are the signature of contemporary control and automation systems thinking (Dimirovski et al., 2006; Stapleton and and Kopacek, 2011).

## 4. CONCLUSION AND FUTURE DEVELOPMENTS

It is a notorious fact that socio-technical systems and the SWIIS tasks for that matter too, hardly can be amenable to any standard and traditional category of systems (e.g. Kopacek, 2008; Morel and Ramanujam, 1991) since more or less they exhibit all known dynamical phenomena at the same time.

As pointed out earlier one of the original ideas of SWIIS was to contribute with system theoretical and systems engineering methods to conflict solution. The SWIIS community started with the classical approaches of control engineering especially control of time continuous systems like theory of linear or some times non-linear systems, modelling, stability, optimisation.

In the history of SWIIS there were some new approaches presented on several events for application of new methods from control engineering to SWIIS problems. Examples are multivariable and timevarying systems as well as fuzzy and neuro methods. An other new approach to the SWIIS problems is the use of methods from manufacturing automation – time discrete systems – as well as the improvement of the interdisciplinarity. This is one of the tasks for the future.

With the changing from SWISS to TECIS some “new” missing subjects in IFAC were now included. (Stapleton and Kopacek, 2011).

The Technical Board’s chairperson and the board more generally, recognised the importance of the work of SWIIS/TECIS to the IFAC global community. The TB encouraged TC 9.5 to continue to embrace an interdisciplinary approach and draw together themes from a range of subject domains. In the long tradition of this TC and in the evolution from SWIIS to TECIS this community has tried always to identify and address gaps concerning interdisciplinary subjects which are relevant (and even pressing) for IFAC and thereby building a bridge between systems control and automation theory and interdisciplinary applications with the main focus on international systems and emerging regions.

To fulfil this task TECIS is organising each year an IFAC event except in World Congress years.

We will continue and are looking forward for TECIS 2018 and 2019, and already there are bids from IFAC NMOs submitted to the Technical Committee for events in the next Triennium.

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