AC 2010-1111: FORMING COLLABORATIVE LINKS BETWEEN TURKEY AND US: INTERNATIONAL WORKSHOP ON RAPID TECHNOLOGIES

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Forming Collaborative Links between Turkey and US: International Workshop on Rapid Technologies

Abstract

As part of a current NSF-CCLI (Course-Curriculum and Laboratory Improvement) grant project, an extra supplementary grant was given in late 2008 to organize an international workshop on Rapid Technologies. This workshop was held in late September 2009 in Istanbul, Turkey. Over seventy academicians and researchers got together and presented the current trends in rapid manufacturing research, education and industry. In this two-day event, educational and technical papers were presented from American, European and Turkish scholars. Reflections of the first and second day have been received from each attendee with an oral interview, and exit survey has been collected to measure the success of the supplementary project and continuously improve the workshop if it is held in the upcoming years. This paper will report the organization of this workshop, and its over-all planning and findings.

Background

Rapid Prototyping (RP) is an almost twenty year old additive manufacturing (AM) technology and it is one of the emerging technologies to keep the USA competitive in a global market. Speed, accuracy and flexibility are the characteristics of RP and are hallmarks of successful, profitable manufacturing. In today's global market the window for meeting market dates is shrinking. Likewise companies cannot afford to make mistakes when they are bringing a product to market. RP allows quick turnaround times from concept to floor production. RP allows 3D modeling of products that help identify possible product flaws and therefore assists the company in quality management control. RP has unique benefits. It allows the fabrication of geometrically complex, low-volume or customized parts.

RP has applications in such diverse industries as manufacturing, nanotechnology, medicine, pharmaceuticals, engineering, prosthetics, construction, art, gaming, automotive racing, archeology, forensics, clothing design and photonics. In the last few years, Author has organized several RP workshops and trained many P16 STEM educators with the technical details and daily use of this technology. In one of his latest two-day-workshops, he provided training to 25 STEM educators with the help of nationally known experts. The details of this workshop are presented at http://iweb.tntech.edu/rpids/2008_RP_Summit.htm. This successful event helped the participants better understand the evolving field of additive fabrication. At the end of the two-day Summit, most of the P16 educators who attended the Summit found this technology extremely versatile and tangibly expressed that "we want to share our learning with our students in science, technology, and math classes." They also started scheduling times to bring their students to TTU RP laboratories.

The current workshop was organized to establish collaborative links between the Turkish and American educators, researchers and engineers in Rapid Technologies. The details and impact of the workshop are presented in this paper.

Mutual International Benefits

This workshop brings together two teams of researchers and educators, which would not otherwise, have the opportunity to work together, for the express purpose of finding common ground to work in an area that potentially can have dramatic economic impact for both counties. Figure 1 shows the organizers and presenters of the international workshop.

Figure 1: A Group of Presenters and Attendees of the Workshop

The session themes and presenters were carefully chosen since they represented major research and development thrusts that will likely have dramatic impact on the future of this emerging technology.

The following is the list of the sessions organized:

- Global Status of the Industry
- State of the Industry in Turkey
- Rapid Technologies in P16
- R&D Trends in Higher Education
- R&D Trends and Educational Innovations in Europe

In addition to the U.S. steering committee members, some other invited participants and European scientists were added into the workshop. Some of the potential benefits of the workshop are given below:

Contribution within the Discipline: This workshop clearly helped the RP researchers identify the major concerns that are shared between these two nations regarding the development of the next generation technologies and processes.

Human Resource Development: This workshop was a unique opportunity for the junior and untenured faculty to gain international exposure, and to see how large-scale international teams and efforts are organized and implemented. This organization helped the researchers and educators of both countries identify common grounds to jointly develop projects to advance the current standing of RP. This effort also helped each of them conduct similar activities in the future using this workshop as one possible model.

Resources for the R&D and Education: The materials presented in this workshop were published via its web page. These materials are freely available for the participants and anyone else who has an interest. These materials are also made available through National Science Digital Library (nsdl.org) as can be seen in Figure 2.

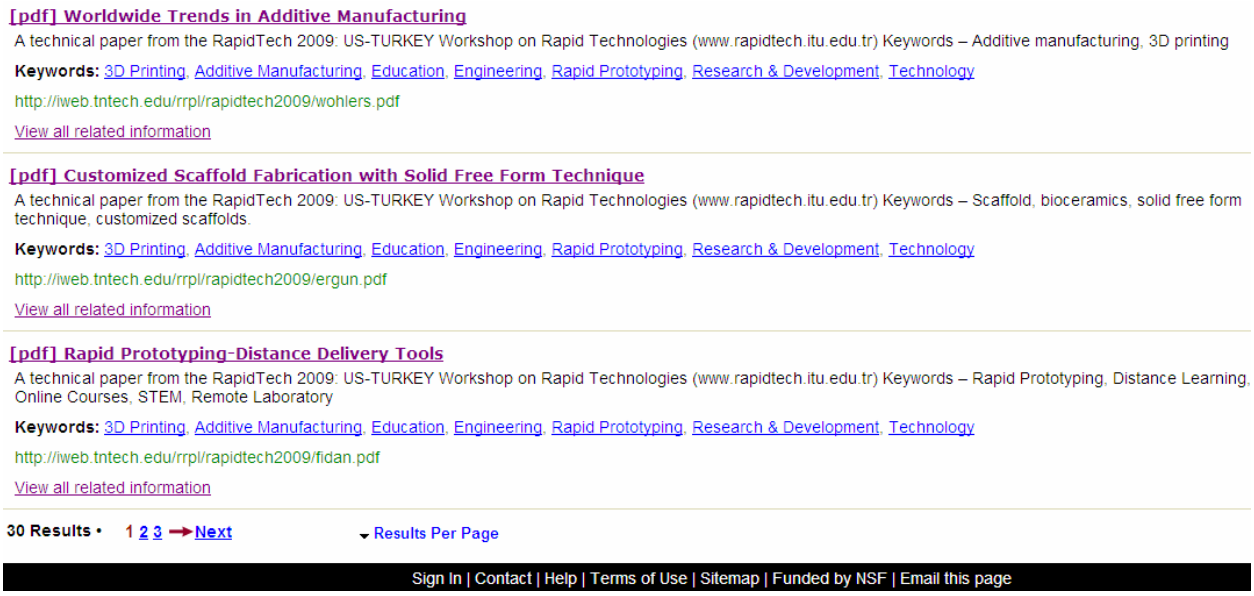

Figure 2: NSDL Links of the Workshop Technical Papers

Current/Future Trends in the RP Field: Technical Representatives of the major US RP system manufacturers (i.e. ZCorp, 3D Systems, and Stratasys) were invited to do hands-on demonstrations during the workshop. Forty-five minutes were allocated for their presentations. CEO of ZCorp, Mr. John Kawola, attended the workshop and made a presentation. He also participated in the discussion forums.

Expected Outcomes

The workshop activities have been designed with the following four expected outputs in mind:

Global Applications of RP: The program must address the state-of- the-art R&D efforts in materials and processes, illustrate the ongoing research of the participants and explore the next steps that must be taken to identify the key research hurdles which will enable and accelerate the next generation materials and processes for broad-scale global application in both industrialized and developing countries. Workshop materials were made available through the National Science Digital Library.

Networking Opportunities: The workshop should promote sustained relationships among participants. Workshop organizers believe that the program must offer ample opportunities for all parties to interact and gain knowledge from each other's perspective fields of interest and expertise. Detailed contact information including the personal and institutional profiles of each attendee was distributed to participants.

Junior Faculty Development: The program must offer ample opportunity for junior faculty members to interact in leadership roles. Priority was given to junior faculty members to attend the workshop. They also attended the boat tour and open discussion forums.

Collaborative, Follow-up Activities: The workshop must identify action plans for any future activities that are mutually beneficial to both nations. This unique opportunity helps the researchers and educators of both countries identify common grounds to jointly develop projects to advance the current standing of RP.

Follow-up Surveys

In order to measure the success of the organized workshop, follow-up reflections were requested from the participants. The results were positive and beneficial to see the results of expected outcomes and international benefits of the workshop. The following section presents some sample responses.

Reflection 1

This was an interesting and exciting meeting. Having the opportunity to see and experience first-hand what is happening in this technology across the world brings new perspective about what is possible, both with the technology and with education programs that teach the technology.

The meeting itself was packed with information. The variety of presentations and organization of the conference was very well done. One suggestion I have is that perhaps when this conference is convened in the future it would be good to have some of the sessions organized as panels and with facilitated discussion and questions. One benefit of having everyone together is to "mine" the thoughts and learning in real time and this could be accomplished with some of the format being facilitated discussion. This discussion would involve the entire group, perhaps breaking the group into smaller discussion groups who would summarize their thinking and insight for the larger group. This can be done in a way that creates a record of the knowledge and insight gained.

I learned a huge amount about the technology and some of what I learned will be incorporated into our Art-to-STEM program for middle school girls. I also think that some of the other people there from Turkey, the US, and other countries gained some insight into how the technology could be more widely used in education and with younger children. This could lead to broader acceptance, understanding, and deployment of the technology itself in years to come.

Reflection 2

The format of the workshop was outstanding. It was enlightening and encouraging to see the adoption of AM technologies in Turkey. This event provided a great networking opportunity and allowed us to explore and discuss issues within the AM community with our global peers. I have already been in contact with two Universities in Turkey and have started sharing curriculum and resources with them. We are now in the process of making plans for future collaboration.

It was enlightening to see that our colleagues in Turkey understand that the adoption of AM technologies within their educational system is critical to providing their future designers and engineers with the competitive skills that they need to compete on a global scale. Equally important our colleagues also understand that the technician level training is imperative to Turkey's ability to compete on a global scale especially facing increasing economic pressures from China.

The one comment that I would like to make about the format of the workshop is I would like to see a specific amount of time set aside every day for networking and open group discussion.

Reflection 3

An event entitled “U.S.–Turkey Workshop on Rapid Technologies” was held 24-25 September 2009 in Istanbul. The U.S. National Science Foundation provided financial support to conduct the workshop, which was held at Istanbul Technical University. ITU is the world’s third oldest technical university dedicated entirely to engineering sciences. The workshop was the first international event of its kind in Turkey and it could not have gone much better. More than 50 people attended from Europe, the Middle East, and the United States.

Dr. Ismail Fidan of Tennessee Tech University did a fine job in organizing most of the speakers, sessions, and topics. Eighteen presentations provided basic and advanced information around the science and application of AM technology. An estimated 380 AM systems have been installed in the country through the end of last year, so a number of people in Turkey are quite familiar with the capabilities of the technology. It is believed that a significant percentage of those systems are from Solidscape and used for making jewelry.

I got the impression that Turkey as a whole is not yet applying AM technology at the same level as countries such as Germany, the UK, or the U.S. Industry and academic events, such as this one, will surely help accelerate the country’s understanding and adoption of the technology. A tentative plan is to hold a second conference, probably in two years. I could envision a second

event with additional speakers, a portion of the conference dedicated to medical applications, and table-top displays and exhibits for those who have equipment, software, and services for sale.

I believe this event has "planted seeds" that could grow into partnerships, long-lasting business contacts and friendships, and collaborations between Turkish organizations and U.S. organizations. I recommend the support of additional activities of this type to further increase the chances of these types of productive activities between our two nations.

Overall, Dr. Fidan and the team at ITU did a very good job with the first one and I'm glad I attended.

Reflection 4

I enjoyed the workshop immensely. It was extremely enjoyable spending time before and after the meeting sessions with Turkish and the American delegation.

I learned a lesson many years ago from a music conductor I played under. He told me once that he used to go nuts over wrong notes coming from the performers. He finally realized that it was better for him to listen to the right notes rather than the wrong ones. So it is with meetings like this. The meeting was well organized, people came and had meaningful exchanges, the groundwork for future collaboration was set, and we got to meet some fine researchers in the US and Turkey.

Reflection 5

The workshop was outstanding; it was very fruitful to assemble such bright minds from both countries to exchange ideas and publications for the two day workshop. It provided a great networking opportunity and assisted in developing relationships for continued work together. I have already heard back from several of the attendees and as a result, am making plans for future collaboration.

The one recommendation I would make for improvement would be to allow time each day (at least once) for open group discussion. When we did this on day two, it generated a great deal of enthusiasm and ideas. It should be built into the program for future workshops. I am already looking forward to the next one, and have begun developing ideas for publication and collaborations.

Reflection 6

US-Turkey Workshop on Rapid Technologies event in Turkey was a big success and opportunity for more than 50 attendees from Europe, Middle East and the United States. I enjoyed the workshop and benefited from the excellent presentations and discussions.

I joined the workshop from NJ. However I knew the capabilities of the Turkish industry and level of research, because I was an alumni and a former faculty member of the Istanbul

Technical University. The research, which is presented by Turkish faculty and researcher, did not surprise me. They have good facilities and knowledge about this advancing technology. I think that the workshop provided a good networking opportunity and I am looking forward for future collaborations among scientists and engineers from the US and Turkey.

I would like to congratulate the local organization committee, since they made a magnificent job.

Workshop Evaluation

Attendees of the workshop completed a hard copy survey at the end of the survey. Each attendee completing the survey received a sealed and signed certificate indicating the successful completion of the workshop. The results of the survey showed the success of the organization. Overall, attendees appreciated the organization of the sessions the most although they had some concerns on the announcement of the workshop.

The following list shows the measurable results of the workshop evaluation. Table 1 shows the averages and standard deviations of each answer.

Q1	Presentations
Q2	Technical Papers
Q3	Final Program
Q4	Time Allowed for each presentation
Q5	Q&A
Q6	Session Organizations
Q7	Length of the Sessions/Days
Q8	Workshop Announcement
Q9	Website
Q10	Registration
Q11	Boat Tour
Q12	Facilities
Q13	Workshop Dates
Q14	Networking Opportunities Interactions

#	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
AV	8.39	8.29	8.71	8.25	8.28	9.08	8.06	7.69	7.78	8.4	8.7	7.88	8.33	8.59
STD.DEV.	1.76	1.85	1.79	1.9	1.72	1.4	1.75	1.91	1.94	2.19	1.64	2.23	1.77	1.65

Quality Rating (1: low, 5: Average, 10: High)

Table 1: Results of the Workshop Evaluation

Conclusion

The objective of the US-Turkey Workshop on Rapid Technologies was to form collaborative links between the faculty members, scientists, and engineers of both countries in the emerging field of RP. The US and Turkish researchers had a chance to talk about collaborative research projects, and establishing long-term networks. Attendees and presenters had enough time to talk

about their current and future research directions and establish collaborative links. The results of the workshop were a great success. Workshop evaluation presented that attendees had high satisfaction rates in the fourteen key aspects of the workshop. The comments and suggestions received from the attendees were very positive and constructive. They were at least proposing the same event to be bi-annual. The support received from the Turkish industry and US non-profit organizations were pretty high. Turkey is a developing country and the rapid technologies are a new market. Organization of this event was timely and very fruitful.

Acknowledgements

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