50th DAC Global Forum

Mexico

More than Tortilla Chips

Roberto S. Murphy, Ph.D.
Instituto Nacional de Astrofísica, Óptica y Electrónica
Electronics Department
Luis Enrique Erro 1, 72840, Tonantzintla, Puebla, México
rmurphy@inaoep.mx

I. Introduction

México (official name United States of México) is a federal presidential republic, consisting of 31 states and a Federal District, commonly referred to as Mexico City. This is the capital and largest city in the country; it is estimated that its metropolitan area is the home to more than 25 million people. Mexico declared its independence from Spain on September 16, 1810, and has been a free and sovereign nation since then. It's the largest Spanish speaking country in the world, with a population of near 116 million inhabitants, but over 50 autochthonous (pre-Hispanic) languages and dialects are still spoken in some regions of the country. Mexico history, however, can be traced to at least 1,000 years BC, the region being continually populated by different ethnic groups, of which the most well-known are the Mayans, Toltecs, Olmecs and Mexicas. Nowadays, the country offers a vast collection of archeological sites, visited by a large number of tourists every year. But the country also offers a plethora of beach destinations, which have become very attractive to visitor from all parts of the planet. Furthermore, the country offers all types of climate and landscapes, history and culture, meeting many criteria for the world traveler.

Besides tourism, the main economic activities are centered in manufacturing, oil exploitation and export, banking services and construction. In recent years, México has become the largest producer of cars in North America, hosting makers such as Ford, Chrysler, Chevrolet, Nissan and Volkswagen. In fact, a large manufacturing plant for Audi is being established in the state of Puebla, aiming at beginning production in 2016. An obvious consequence of the installed infrastructure for the automobile companies are all the associated parts and services industries, which provide direct and indirect employment for thousands of people in the country.

In summary, Mexico is the 14th economy in the World, and it is aiming at becoming a leading actor in global development. As a consequence of research and development, the country will shortly be known for its integrated circuit designs and chips, much more so than for its Tortilla chips.

II. Chip Design and EDA presence

In the recent past, some global microelectronics industries have established Design Houses in the country, especially in the city of Guadalajara in the state of Jalisco. These have prompted an academic development in the field of integrated circuit design for a host of applications, increasing the demand for highly trained professionals in the field. The establishment of more Design Houses is expected in the near future, and thus, undergraduate and graduate programs in the different fields of microelectronics are modernizing their curricula to include more related subjects.

III. Academia

The first efforts to form highly prepared human resources in microelectronics can be dated to 1974, when the INAOE (National Institute for Research in Astrophysics, Optics and Electronics), in the state of Puebla, established the first clean room in Latin America. This facility was initially designed for Integrated Injection Logic (I^2L) processes based on bipolar transistors, but it soon evolved to a complete CMOS process. This laboratory served as the basis for the development of microelectronics in Mexico, being associated to the first graduate program in the field, the Master's Program in Electronics. A brief description of the INAOE can be found in

Capital	Mexico City
Largest city	Mexico City
Language	Spanish (predominantly)
Area Total	1,972,550 km^2 (14th)
Population (2012 estimate)	115,296,767
Currency	Mexican Peso (MXN)
Time zone	UTC -6 to -8
Internet TLD	.mx

[1].

Up to date, more than 540 students have received the M.Sc. degree from the INAOE, and a large proportion of them have done it in fields related to integrated circuit design and fabrication processes. In 1993, a Ph.D. program in Electronics was founded, and close to 100 candidates have obtained their degree since then, mostly in the areas of integrated circuit design and microelectronics in general, covering the fields of fabrication processes, solid-state sensors, MEMs, and nano-structured materials for high performance devices.

Many of INAOE's graduates have established microelectronics programs in different universities and research centers in the country, promoting thus education in these fields.

Some of the most well-known centers dedicated to microelectronics in Mexico, besides the INAOE, are:

CINVESTAV Guadalajara Unit. The CINVESTAV is one of the oldest research centers in Mexico, covering many areas of science, having been founded in 1961. It now has several units throughout the country, but the one in Guadalajara is mostly dedicated to integrated circuit design, especially since there are Design Houses in this city [2].

Veracruz University. This university founded MICRONA in 2003. It is a research center in Micro and Nano Technology, which also offers a graduate program in the field [3].

ITESO. Is a private university in Guadalajara, which has also promoted education in microelectronics in the recent past, offering graduate programs in the field [4].

Additional information, focused in Mexico's effort to also become a leading actor in high frequency physics and characterization of devices can be found in [5].

IV. Government Programs

The main support for scientific and technological development in the country is due to the National Council for Science and Technology (CONACyT) [6]. This council was founded in 1971 to support science and technology, but since then it has broadened its scope to cover all areas of human knowledge. CONACyT's support actions include the following:

a) Scholarship programs. The Council grants full scholarships to students to pursue graduate studies, independently of nationality. The main requirement is that the student be enrolled in a program registered in the National Registry of Quality Programs (PNPC). This registry consists of 1,601 graduate programs in Mexico, which have been accredited by the Council based on their quality. The students in these programs are also required to have a GPA of at least 8.0/10.0 in their undergrad studies, and maintain it during their graduate course.

b) Research grants. The Council has several programs that support scientific research and technological development through grants. In many cases, these require concurrent funds from the institution or other agencies.

c) The National System of Researchers (SNI). Is a program founded in 1984 to stop the brain-drain. It consists of recognition and an economic stimulus for researchers who demonstrate a high academic production. Currently, there are close to 20,000 researchers members of this system.

d) Postdoctoral fellowships. Granted to recent doctoral graduates to work with a research group in a university or research center different from the one where they obtained their degree. These stays can be of a maximum of two years.

e) Fiscal incentives. To companies that have important R&D activities and groups in the country, and as long as they contribute to the development of the nation.

The different activities en EDA have found ample support from the Council, and no doubt as research groups become stronger and more numerous, the council will be tapped for more resources.

References

[1] J.M. Fernández, J. Inclán, "INAOE Reseña Histórica", INAOE, 2000, ISBN 968-7938-00-5.

[2] http://www.gdl.cinvestav.mx/

[3] http://www.uv.mx/veracruz/microna/

[4] http://portal.iteso.mx/portal/page/portal/ITESO/Aspirantes/Posgrados/Oferta_academica/Maestria/MDE

[5] R. Murphy, R. Torres, "MTT World: Microwave Engineering in Mexico", Microwave Magazine, Vol. 11, No. 6, October 2010, pp. 152-148.

[6] http://www.conacyt.gob.mx

Roberto S. Murphy studied Physics at St. John's University, Minnesota, and got his M.Sc. and Ph.D. degrees from the National Institute for Research on Astrophysics, Optics and Electronics (INAOE), in Tonantzintla, Puebla, México. He has published more than 100 articles in scientific journals, conference proceedings and newspapers, and is the author of a text book on Electromagnetic Theory. He is currently a senior researcher with the Microelectronics Laboratory, and the Academic Dean of the INAOE. His research interests are the physics, modeling and characterization of the MOS Transistor and passive components for high frequency applications, especially for CMOS wireless circuits, and antenna design. Dr. Murphy is a Senior Member of IEEE, Chairman of ISTEC's Board of Directors, a member of the Mexican Academy of Sciences, and a member of the Mexican National System of Researchers (SNI).