Payments by instalments versus funding by instalments

Most of us are familiar with payments by instalments. If there is no interest on the delayed payments, for a total payment of 1, there is a front payment of \( p_0 \) followed by a series of \( n \) instalments \( p_i = (1-p_0) / n \) such that at the end we have paid the total amount due, that is \( p_0 + n (1-p_0) / n = 1 \).

Many have assumed that FCT funding would follow a similar rule for the contractual funding. This is certainly not the case and it is worthwhile to go further into the details.

Assume that the research unit only uses FCT contract payments to execute the contract (a safety precaution explained later). As before, assume that the total contractual funding is 1 and the advance payment is \( p_0 \).

FCT funding rules stipulate that the subsequent payments will be \((1-p_0)\) of the submitted eligible expenses. Assume further that the research unit complies in full, presents the value of \( p_0 \) as eligible expenses in the cost statement and FCT pays instantaneously \( p_0 (1-p_0) \).

If the process continues smoothly, after \( n \) payments, FCT would have paid the unit \( p = \sum_{i=0}^{n} p_i (1-p_0)^n \).

Simple maths will tell that this sum only reaches 1 (that is the contractual funding) when \( n \) reaches infinity!

Introducing a minimum amount for the cost statement (and the payment) \( p_{\text{min}} \) (again expressed as a function of the contractual funding) implies that \( p_0 (1-p_0) > p_{\text{min}} \) and \( n < \log(p_{\text{min}}/p_0)/\log(1-p_0) \).

In the figure we show the total amount paid \( p \) for \( p_0 = 0.15 \) (value adopted by FCT), as a function of the minimum cost statement \( p_{\text{min}} \). From the figure we get for \( p_{\text{min}} = 0.05 \), equivalent to a minimum cost statement of 50 k\( \varepsilon \) (as FCT stipulates) on a contractual funding of 1000 k\( \varepsilon \), that the total amount paid is just 680 k\( \varepsilon \).

Using own funds could improve this result. The institution would have to borrow or have free on its savings near \( p_0 (1-p_0) \) to be able to receive the total contractual funding from FCT (about 125 k\( \varepsilon \) for a 1000 k\( \varepsilon \) contract).

Of course the situation described is purely hypothetic. In real life \( p \) is considerably lower as there is a time lag between payment and cost statement and an even greater time lag between cost statement and the subsequent payment. If own money is used to enhance the execution rate, there is no guarantee that the advanced funds are completely paid back, at least within reasonable time to pay the loan.

No wonder execution rates are low. The system is designed to keep them low. Intentionally.

Carlos Salema

In this issue

- Notícias Magazine bets on IT researcher for 2014
- Best Student Paper award at PHOTOPTICS 2014
- PhD Students

Project Snapshot: Implantable Organic Nano-Electronics (iONE-FP7)

By Henrique Gomes.
Spinal Cord Injury (SCI) is a damage or trauma to the spinal cord that results in a loss or impaired function causing reduced mobility or feeling. SCI is a devastating and debilitating condition affecting 2.5 million people worldwide.

The objective of iONE-FP7 project, which is a European consortium of twelve European partners, financed by the European Commission Seventh Framework Programme (FP7), is to develop and test flexible organic electronics for the treatment of Spinal Cord Injury (SCI). Several devices able to stimulate neuron cells with electro-chemical substances, supply drugs and monitor the evolution of neuronal cells, will be integrated into an Active Multifunctional Implantable Device (AMID) that will be surgically implanted.

These transistors have the capability to promote nerve regeneration by a combination of local stimuli delivered on demand, sense inflammation, and control the immune-inflammatory response.

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Prototypes devices (see Figure) have been fabricated and tested at the laboratories of the Organic Electronics Group, Instituto de Telecomunicações (IT-Lx). The biomedical impact of the project will be demonstrated in vitro and in vivo. In vitro, the neural therapeutic plasticity induced by the iONE device will be evaluated on stem cells, which will be differentiated to neural progenitor cells, and then to neural cells. In vivo, Hugo Silva, PhD student supervised by Ana Fred from the Pattern Image and Analysis Group at IT in Lisbon, is one of the top promising youngsters for 2014 according to an article published in Notícias Magazine. The creator of BITalino is in the news again

Notícias Magazine, the sunday magazine of the Portuguese newspapers Diário de Notícias and Jornal de Notícias, asked 14 personalities from different areas - including literature, science, music, cinema, gastronomy and technology - to choose the most promising youngsters in their field. António Câmara, founder of YDreams, elected Hugo Silva as his «bet» for 2014 in the area of Technology because of his «capabilities of invention and commercial sense, expressed in the successful BITalino». BITalino is a low cost toolkit that allows anyone to create projects and applications with biosignals.


PROJECT SNAPSHOT

iONE-FP7: Implantable Organic Nano-Electronics

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The electronic implant will be fabricated using biocompatible and flexible organic electronics devices (ultra-thin film organic field effect transistor (OFET). These transistors have the capability to promote nerve regeneration by a combination of local stimuli delivered on demand, sense inflammation, and control the immune-inflammatory response.

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Photon-Pair Generation in Chalcogenide Glass: Role of Waveguide Linear Absorption

Quantum communications apply fundamental laws of quantum physics to encode, transmit, store and process information. The most successful and important application is the quantum key distribution (QKD). The QKD systems are supported by technologies capable of processing single or even entangled photon pairs.

In the paper “Photon-Pair Generation in Chalcogenide Glass: Role of Waveguide Linear Absorption” by the PhD student Nuno A. Silva and his advisor Armando Nolasco Pinto from the Optics and Photonics Group from IT in Aveiro, they analyze the impact of loss and Raman scattering on the generation of quantum correlated photon pairs through the spontaneous process of four-wave mixing (FWM) in a highly nonlinear glass. Those correlated photon-pairs can be used to implement conditional single photon sources, or even entangled photon sources.

In both cases, those photon sources are essential elements in a QKD system. Moreover, waveguides with high values of nonlinear parameter are essential resources for implementing on-chip quantum technologies, since they allow efficient generation of photon-pairs over very short distances. However, that kind of waveguides tends to present a high value of loss coefficient. Nevertheless, they observed that in certain regimes the waveguide loss improves the degree of correlation between the photons generated by the spontaneous FWM process. Moreover, they have demonstrated that the waveguide absorption also reduces the generation rate of uncorrelated photons due to the spontaneous Raman scattering or due to stimulated FWM process.

The paper received the Best Student Paper Award at the 2nd International Conference on Photonics, Optics and Laser Technology (PHOTOPTICS 2014) that was held last month in Lisbon.
Latest concluded PhDs hosted by IT

Nelson Costa
Optical fibre telecommunications systems with multi-symbol phase modulation
PhD degree in Electrical and Computer Engineering by IST, April 2013, supervised by Adolfo Cartaxo (IST) and co-supervised by Daniel Fonseca (NSN).
The thesis addressed the research on optical fiber transmission systems which use phase modulation to transmit information, namely the differential quadrature phase shift keying (DQPSK) and coherent detection quadrature phase-shift keying (CP-QPSK) modulation formats.
Nelson is currently working in Research&Development in Coriant.

Ricardo Matos
Context-based Wireless Mesh Networks
PhD degree in Electrical Engineering by the University of Aveiro, January 2013, supervised by Susana Sargento (UA).
The thesis focused on the mechanisms to build an architecture that splits a wireless mesh network into a set of personalized virtual networks, thus becoming feasible to form networks connecting clients that share the same (or similar) context requirements.
Ricardo was born in 1985 and he is currently working at Veniam’Works, a tech startup based in the US and in Portugal that develops unique vehicular networking solutions.

Carlos Alberto Ferreira
Amplitude Modulation in Resonant Converters for Audio Amplification
PhD degree in Electrical and Computer Engineering by the University of Coimbra (UC), Fevereiro 2013, supervised by Beatriz Borges (IST) and co-supervised by Luís de Sá (UC).
The thesis proposed a new phase modulation system, adapted to a resonant converter that carries out Amplitude Modulation. It was used in audio power amplification.
Carlos was born in 1972 and joined the IT Power Electronics Group of Lisbon in 1999.

Luís M. Borges
Enhanced Two-phased Contention Windom MAC Protocol for Wireless Sensor Networks Applications
PhD degree in Electrical and Computer Engineering by the University of Beira Interior, February 2013, supervised by Fernando Velez and António Lebres (UBI).
The thesis addressed the proposal of a new reliability-based packet reception decision algorithm for the PHY layer and the proposal of Multi-Channel Scheduled Channel Polling (MC-SCP-MAC) protocol for high density scenarios in WSNs.
Luís was born in 1983 and is currently a Post-Doc researcher in the CREaTION project.

Where are you now?

Ricardo Queirós
After completing his Master of Technology in Electrical Engineering in Cape Town, South Africa, Ricardo joined the IT’s Instrumentation and Measurements Group in 2002 as a PhD student under the supervision of Professors António Cruz Serra and Pedro Silva Girão. Following his previous work on ultrasonics, his PhD thesis was about high resolution ultrasonic measurements. Specifically, he developed methods to estimate the time-of-flight, which is the time the ultrasonic wave takes to propagate from the transmitter to the receiver, with application in distance, thickness and angle measurements.
“I still remember the long working and exciting hours at the IT’s Instrumentation and Measurement Laboratory and the great support I received from my colleagues. The PhD definitely changed the way I perceive the world.”

After completing his PhD in March 2008, he moved to work in Luanda-Angola, as an Assistant Professor, at the Universidade Agostinho Neto, at the time the only public and the most prestigious university in Angola. Ricardo currently teaches Electrical and Electronic Measurements, supervises theses and coordinates research projects. Meanwhile, he was temporally the Engineering Faculty Dean of the Universidade Metodista de Angola, where he had a great university managing experience.

On the other hand, since 2010 he has been Technical Consultant at the Ministry of Science and Technology of Angola, where among other activities, he gives strategic advices and represents the Ministry in important Science events, locally and internationally.