

## PLENARY TALKS

### **Research, Innovation and Education in Infocommunication Technology**

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The Eötvös Loránd University participates as the leader of the Budapest Associate Partner Group in the European Institute of Innovation and Technology (EIT) Information and Communications Technology Labs (ICT Labs). Researchers and also students from universities and industrial partners, more than two hundred researchers work on dozen innovative Research and Development projects. Their innovation potential is supported by national, European and EIT ICT Labs grants and funds. A joint project (EITKIC\_12-1-2012-0001) of ELTE and BME – built on new basic research results – targeted the development of reliable technologies that help our daily lives in the increasingly developing world of ICT solutions and provides assistance for a wide range of users and IT enterprises, e.g. solutions to predict traffic jams, games that develop inductive reasoning, infrastructures to test mobile applications, solutions to defend critical systems, or an innovative speech synthesizer for future railways. The joint international Master School of EIT ICT Labs was launched with the participation of ELTE and BME; 10 students started their studies in two different Technical Majors at ELTE in September 2013. The EIT ICT Labs Budapest Doctoral Training Centre provides business development courses for PhD students of the ICT Doctoral Schools of ELTE and BME.

### **Transient stabilization of unstable states: why a stick balanced at the fingertip always falls?**

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The prevention of falls in the elderly, and their accompanying mortality and morbidity, are major challenges faced by aging industrialized societies. Increased risks of falling are associated with diseases of aging, such as diabetes, which enlarge sensory dead zones of peripherally located sensory receptors related to balance control. The sensory dead zone represents a range of the controlled variable over which no output is generated. Consequently mathematical models for balance control are posed as switching, or hybrid, type models in which the feedback control is turned on whenever the controlled variable exceeds a sensory threshold. From a dynamical point of view the presence of a dead zone represents a small-scale nonlinearity which does not affect large-scale linear stability, but can produce complex dynamics including limit cycle oscillations and micro-chaos. Here it is shown that for such systems it is possible that balance can be maintained for as long as minutes even though the feedback control is asymptotically unstable! Thus, for example, a stick balanced at the fingertip, an important laboratory paradigm for investigating the neural control of balance, can eventually fall no matter how skilled the stick balancer. These observations support the hypothesis that techniques which modify sensory dead zones, such as noisily vibrating insoles, may be useful to reduce the risk of falling in the elderly.