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Title: Control-oriented Modelling of Tumor and Tumor Vasculature Growth

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Abstract

The computational modelling of tumor growth has been a widely researched area in the literature in the past decades. Since recently the mechanisms of pathological tumor-related vascularization processes have been partially revealed by biology and medicine, these modelling approaches have been complemented by vascularization models as well. However, it is quite problematic to find a tumor-vasculature model which is applicable for closed loop control design.

On the one hand, very simple phenomenological (or minimal) models are available to describe the tumor growth, but these models do not incorporate formalization and representation of essential biological mechanisms, thus have a limited validity regarding e.g. how a predefined therapy corresponding to vascularization. Some variables of these models (e.g. the Hahnfeldt model) are not easy to interpret and the validity of their dynamics is questionable in the light of the latest biological and pathological findings. On the other hand, very detailed multiscale models deal with biological, chemical and mechanical processes taking place during tumor growth, which are too complex for control design methods.

Our aim is the synthesis of a low complexity tumor and tumor vasculature growth model, which is in accordance with the latest biological findings regarding the nature of tumor and tumor vasculature growth, formalizes the most important processes taking place during the process making controller design possible.

Short bio



Dávid Csercsik received his MSc in electrical engineering, specialized in systems and control engineering and biomedical technology in 2005 from Budapest University of Technology and Economics (BME). He received his second degree in Biomedical Engineering in 2007 BME as well. He obtained his PhD in Information Science from the Tamás Roska Interdisciplinary Doctoral School at the Pázmány Péter Catholic University Faculty of Information Technology and Bionics (PPKE ITK). He is currently employed as assistant professor at the PPKE ITK, and as research fellow at Óbuda University, Physiological Controls Research Center corresponding to the ERC StG Grant No 679681. His research interests include systems biology, game theory, optimization and modelling of complex systems and networks.