Mapping biochemical applications onto microfluidic biochips

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Abstract

Microfluidic biochips are replacing the conventional biochemical analyzers, and are able to integrate on-chip all the necessary functions for biochemical analysis. There are several types of microfluidic biochips, each having advantages and limitations. In flow-based biochips the microfluidic channel circuitry on the chip is equipped with chip-integrated microvalves that are used to manipulate the on-chip fluid flow. By combining several microvalves, more complex units like mixers, micropumps, multiplexers etc. can be built up, with hundreds of units being accommodated on one single chip. In droplet-based biochips, the liquid is manipulated as discrete droplets on an electrode array. For both types of biochip, the synthesis process, starting from a biochemical application and a given biochip architecture, determines the resource allocation, binding, scheduling and placement of the application operations, resembling the mapping process for multi-core platforms. In this talk I will illustrate how techniques and methods from multi-core platforms can be used to solve synthesis and optimization problems of biochips.

Brief Bio

Jan Madsen is Professor in computer-based systems at DTU Informatics at the Technical University of Denmark. He is Deputy Head of the Department of Informatics and Head of the Section on Embedded Systems Engineering.

His research interests are related to design of embedded computer systems. In particular, system-level modeling and analysis of multiprocessor systems, including real-time operating systems and hardware/software co-design. He is interested in design methodologies and implementations of embedded systems, covering areas of adaptable systems, wireless sensor networks and biochips. He has published more than 110 publications in international journals and conferences as well as co-authored 11 book chapters.

Jan Madsen is the lead delegate for Denmark in the Governing Board of the ARTEMIS Joint Undertaking, a pan-European research initiative for public-private partnership in Embedded Systems. He is on the steering committee of InfinIT, a national innovation network on ICT, where he is coordinating the strategic focus area on Embedded Systems. He is principle investigator in SYMODEL and ASAM (both funded by ARTEMIS JU). He is participating in ProCell (NABIIT), programmable biochips, and in Wireless Sensor Network for Climate and Environmental Monitoring together with DELTA.