Model predictive control and self-learning of thermal models for thermal control for multi-core platforms
(Luca Benini)

High-end multicore processors are characterized by high power density with significant spatial and temporal variability. This leads to power and temperature hot-spots, which may cause non-uniform aging and accelerated chip failure. These critical issues can be tackled on-line by closed-loop thermal and reliability management policies. Model predictive controllers (MPC) outperform classic feedback controllers since they are capable of minimizing a cost function while enforcing safe working temperature.

Unfortunately, basic MPC controllers rely on a-priori knowledge of multicore thermal model and their complexity exponentially grows with the number of controlled cores. Hence, we need scalable thermal management solutions with advanced model learning, as in most practical cases thermal models are partially or even fully unknown at deployment time.

In this talk I will present approaches to achieve controller scalability based distributed MPC and techniques for thermal model learning which take into account several non-linear effects and practical operational constraints on automatic model construction and calibration. These are the first steps toward a vision of a vertically-integrated, multi-scale thermal management solution for die, board, rack, room and entire data-center.

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He has published more than 500 papers in peer-reviewed international journals and conferences, four books and several book chapters. He has been general chair and program chair of the Design Automation and Test in Europe Conference. He has been a member of the technical program committee and organizing committee of several conferences, including the Design Automation Conference, International Symposium on Low Power Design, the Symposium on Hardware-Software Codesign. He has been Associate Editor of several international journals, including the the IEEE Transactions on Computer Aided Design of Circuits and Systems and the ACM Transactions on Embedded Computing Systems. He is a Fellow of the IEEE, a member of the Academia Europaea, and a member of the steering board of the ARTEMISIA European Association on Advanced Research & Technology for Embedded Intelligence and Systems.