Graz University of Technology

Institut für Signalverarbeitung und Sprachkommunikation

Assoc.-Prof. DI Dr. Franz Pernkopf

Inffeldgasse 16c
8010 Graz, Austria

Tel: +43 316 873 4436
Fax: +43 316 873 104436

pernkopf@tugraz.at
www.spsc.tugraz.at

DVR: 008 1833 UID: ATU 574 77 929

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Invitation for a Guest Lecture

Dear colleagues,

I want to invite you to the guest lecture *"From controller to code: an overview of the finite-precision implementation flow"* of Prof. Thibault Hilaire, Université Pierre et Marie Curie (Maître de Conférences), Laboratoire d'Informatique de Paris, at Friday, January 27th, 2017 at 2pm, Seminar Room IDEG134 at Inffeldgasse 16c.

Please forward this invitation to your colleagues.

Hope to see you all there!

Franz Pernkopf

Abstract

Transforming an algorithm from mathematical notation to fixed-point code running on some CPU or custom hardware is a complicated and error-prone task that requires large skills (numerical analysis, computer architecture, computer arithmetic, etc.), especially when we want guaranty on the numerical quality of the code.

This task is typically performed using simulation tools (like Matlab/simulink) that help developers/designers to evaluate (using simulation) the impact of the finite precision computations. But this approach does not provide any guarantee on the numerical quality of the implementation, and thus no mathematical bound on the output error.

Moreover, applied to signal processing or control algorithms, this approach cannot deal with implementation possibilities, like the reorganization of the algorithm (several structures exists for a given linear filter), the reorganization of the computation reorder, the bit-width optimization, etc.

We will present a complete flow, applied to linear signal processing/control algorithm (but not restricted to) that provides fixed-point (or floating-point) implementations from mathematical specification. with a reliable bound on the output error. This is based on basic bricks like a reliable evaluation of the magnitude of each variable (in order to define their fixed-point format and guaranty that no overflow will occur), an error analysis to bound the output error (difference between the exact algorithm and the implemented one), a bit-width optimization (smallest bit-width that still guaranty the error to be bounded by a given epsilon), and fixed-point code generation (C code with integers, or VHDL operator).

Biography

Thibault Hilaire received the M.Sc. and Ph.D degrees in applied mathematics and computing sciences from University of Nantes, France, in 2003 and 2006, respectively. He is currently associate professor at the Sorbonne Universités, Université Pierre et Marie Curie (UPMC), Paris, France. His researches are mainly focused on implementation of mathematical objects (like Signal Processing filters, controllers, etc.) into embedded digital devices (i.e. into software running into processors or dedicated hardware) with numerical issues (finite precision concerns) in mind.