2017-00092 - Tracking (un)stable poles during stability analysis of microwave circuits

Contract type: Internship agreement  
Level of qualifications required: Graduate degree or equivalent  
Fonction: Internship Research

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Context
A large part of the design of modern analog electronic circuits is performed using computer simulations due to the very high prototyping costs. The performance and robustness of a circuit are all verified on the computer first before an actual prototype of the circuit is constructed.

Stability is one of the most important circuit properties that has to be guaranteed in the circuit simulator. A solution of a circuit's equations is stable when it can recover from a small perturbation. When an unstable solution is perturbed, the circuit will not return to the original solution, but will move to another, possibly unwanted, solution.

Take an amplifier as an example. When there is no signal applied to the input of the amplifier, there should be no output signal. When the equilibrium solution of the amplifier is unstable however, an amplifier without input signal will generate strong oscillations. This instability will reduce the amplifier's performance and can cause the transistors to overheat. Instability in an amplifier needs to be avoided.

An oscillator, on the other hand, is designed to have an unstable equilibrium solution. This causes the oscillator to generate a signal of its own at a wanted frequency. For the design of both amplifiers and oscillators, designers need fast and reliable stability analysis tools.

To test the stability of a circuit solution in the simulator, the circuit is linearised around this solution and a frequency response function is obtained. When this function has poles in the complex right half-plane, the solution is unstable. Local stability analysis therefore boils down to determining whether a given complex function has poles in the right half-plane or not.

General Information
• Theme/Domain: Optimization and control of dynamic systems  
Scientific computing (BAP E)  
• Town/city: Sophia Antipolis  
• Inria Center: CRI Sophia Antipolis - Méditerranée  
• Starting date: 3/1/18  
• Duration of contract: 6 months  
• Deadline to apply: 1/31/18

Contacts
• Inria Team: APICS  
• Recruiter: Seyfert Fabien / fabien.seyfert@inria.fr

Conditions for application
Defence Security:
This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST). Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

Recruitment Policy:
As part of its diversity policy, all Inria positions are accessible to people with disabilities.

Warning: you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.
Assignment
At APICS, we have recently developed an analysis tool that can determine the stability of a given frequency response function. The goal of this internship is to help with the development of this stability analysis technique.

More specifically, you will use and modify our analysis tool to implement pole-tracking. Pole-tracking allows to study the movement of the poles of the linearised circuit when the circuit parameters vary. With access to this information, a circuit designer can speed up his or her design cycle and improve the robustness of the design.

Main activities
During the internship, you will invent a pole-tracking algorithm, implement your algorithm in Matlab and apply it to both synthetic and real examples to verify its performance.

Skills
You need a strong background in complex analysis and applied mathematics. Also, a good level of programming is required (Matlab). Some basic knowledge about electronic circuits or systems and control theory can help.

Benefits package
- Subsidised catering service
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- Paid leave
- Flexible working hours
- Sports facilities