

Open Early Stage Researcher/PhD Position at Bergische Universität Wuppertal, Germany, and ST Microelectronics, Italy, as part of

European Innovative Training Network

**Reduced Order Modelling, Simulation and Optimization of Coupled systems  
(ROMSOC)**

ROMSOC is a European Industrial Doctorate (EID) project in the programme Innovative Training Networks (ITN) and part of Marie Skłodowska Curie Actions within the Horizon 2020 programme. The ROMSOC EID Network brings together 15 international academic institutions and 11 industry partners and supports the recruitment of eleven Early Stage Researchers (ESRs). Each ESR will be working on an individual research project in the host institution with secondments related to their research in other academic and industrial partners of the network. The research is focused on three major topics: coupling methods, model reduction methods, and optimization methods, for industrial applications in well selected areas, such as optical and electronic systems, economic processes, and materials. The ROMSOC EID Network offers a unique research environment, where leading academics and innovative industries will integrate ESRs into their research teams for the training period, providing an excellent structured training programme in modelling, simulation and optimization of whole products and processes.

We seek excellent open-minded and team-spirited PhD candidates who will get unique international, interdisciplinary and inter-sectoral training in scientific and transferable skills by distinguished leaders from academia and industry. Within the ROMSOC network we offer the following PhD position at Bergische Universität Wuppertal and ST Microelectronics:

**Coupling of Model Order Reduction and Multirate Techniques for coupled heterogeneous time-dependent systems in an industrial optimization flow**

Reference number: ROMSOC-ESR05

In industrial circuit and device simulation, e.g. for estimating failure probabilities due to aging, simulation problems have to be run many times in the loop of an optimization flow. This can only be done by drastically reducing simulation costs via model order reduction (MOR). This is particularly challenging in the case of coupled systems when using various simulation packages for the different subcomponents and physical domains. For efficiency, MOR and multirate error estimates have to be linked to define overall error estimates, balanced to the accuracy requirements of the iteration level of the optimization flow.

Consequently, the PhD candidate has to combine advanced concepts of MOR, multirating on hierarchies of submodels and manifold mapping techniques such that the overall properties of the system (such as passivity, energy conservation etc.) and stability of the dynamic iteration process are preserved:

- Generation and analysis of test sets of coupled heterogeneous systems used in the optimization flow of ST Microelectronics
- New MOR techniques for hierarchies of subcomponent systems preserving stability of dynamic iteration schemes.
- Error estimates based on MOR and multirate error estimates allowing for adaptivity of the optimization flow.
- Implementation and validation of software of new techniques for test sets of industrial partner.

The PhD candidate will spend secondments for technical and scientific training at ST Microelectronics (Italy). The PhD degree will be awarded by Bergische Universität Wuppertal, Germany.

**Requirements:**

- Master degree (or equivalent) in Mathematics, Mathematical Engineering, Scientific Computing or other related disciplines.
- Experience in numerical analysis of time-dependent differential equations, model order reduction and/or multirate schemes, coupled heterogeneous modeling.
- Programming skills in object oriented languages as well as Python/Matlab.
- Strong interest in interdisciplinary scientific work.
- Ability to work independently and as part of a team.
- Strong motivation to pursue a PhD degree.
- Preferred qualifications include excellent grades, research talent (as proven by the master thesis), affinity with mathematical modeling and simulation in engineering applications, and personal ambition.
- Excellent command of English, together with good academic writing and presentation skills.

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| <b>Starting Date:</b>       | 1st of March 2018  |
| <b>Contract:</b>            | Full-time contract for 36 month (18 month at each hosting institution)   |
| <b>Host institutions:</b>   | Bergische Universität Wuppertal, Wuppertal, Germany<br>ST Microelectronics, Catania, Italy   |
| <b>Salary:</b>              | The Marie Skłodowska-Curie programme offers highly competitive and attractive salaries. Gross and net amounts are subject to country-specific deductions as well as individual factors and will be confirmed upon appointment.   |
| <b>Information/Contact:</b> | Univ.-Prof. Dr. Michael Günther (Primary Supervisor)<br>Email: guenther@uni-wuppertal.de   |
| <b>Application:</b>         | Applications (motivation letter, detailed CV, certificates, list of MSc courses and grades, copy of the master thesis, reference letter etc) with indication of the position reference number should be send to guenther@uni-wuppertal.de<br>Applicants that apply for more than one individual research project should indicate the order of preference (e.g. 1st, 2nd and 3rd choice). |
| <b>DEADLINE</b>             | <b>15.12.2017</b>  |

To ensure the equality of opportunities we strongly encourage women with the appropriate qualifications to apply. If equally qualified, handicapped applicants will be preferred.

**Eligibility:** *The candidate recruited in the ROMSOC project must be in the first four years from the date when the candidate obtained the degree entitling him or her to embark on a doctorate (e.g. master degree). No doctoral degree has been awarded during these four years. The candidate must not have resided or carried out her/his main activity (work, studies, etc.) in the host country for more than 12 months in the 3 years immediately prior to the recruitment date. Compulsory national service, short stays such as holidays, and time spent as part of a procedure for obtaining refugee status under the Geneva Convention are not taken into account. The candidate must work exclusively for the project during the employment contract. The candidate must fulfill the conditions to be admitted in the PhD programme indicated in the job vacancy. Tuition fees will be covered by the fellowship. These conditions must be fulfilled at the starting date of the contract. The starting date for each position is tentative.*