DAAD program RISE 2010
Physics:
Chaos synchronization of lasers

Applicant:
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The activities of our group are centered around theoretical investigations and computer simulations of nonlinear dynamical systems. We deal with dynamical systems from different areas of real world applications ranging from neural systems to lasers. Our main focus lies on the influence of delay and noise on system properties such as stability, coherence, chaoticity and synchronization.

Due to the importance of lasers in optical communication the synchronization of chaotic lasers is particularly interesting and may give rise to new secure communication schemes. Delays are always present in coupled optical systems due to the finite speed of light and the fast time scale of the devices. For chaos based applications delays play a crucial role because they render the systems infinite dimensional and allow high dimensional chaos (hyperchaos).

Multiple coupling delay lines have previously been shown to generate interesting dynamical behavior and enhance chaos synchronization. The aim of this work is to generalise previous results on the synchronization of lasers and optoelectronic devices in simple coupling topologies to include multiple delay lines.

The candidate will first get an introduction to the dynamical equations and get an overview of the previous work in this field. Later on, the candidate will perform numerical simulations of the equations using and extending the tools and programs developed in our group. The data analysis of the results will help us to understand the influence of multiple coupling delays on chaos synchronization. Thus, the task is embedded in current scientific projects carried out in our group.

The work will be performed in the group of Prof. Schöll which is located in the Institute for Theoretical Physics at Berlin University of Technology (Technische Universität Berlin). The Technische Universität has a long tradition in science and engineering since its foundation over 125 years ago. It is nowadays a premier research institution with many international cooperations.

Berlin as the capital of Germany is a center of science and research with many research institutions of high academic reputation. It is also a very green city with many parks, lakes around the city, and a lot of interesting things to see in the nearby area. Because of a wide range of cultural facilities in a very open-minded environment, the candidate will benefit from a lot of stimulating impressions not only from scientific work in our group but also from the city of Berlin itself.