EURYI Awards 2004

Press Information

Dr. Ole SIGMUND

– Mechanical Engineering –

Project:

Synthesis and Topology Optimisation of Optomechanical Systems

Almost all optical systems are influenced by mechanical loadings. This influence may degrade the performance of optical devices or it may be used positively in certain sensor applications. Examples of the former are frequency shifts due to thermal fluctuations and changes in refractive indices due to mechanical processing. Examples of the latter are fibre-optics based hydrophones where pressure induced straining of Bragg gratings can be detected as frequency shifts and in photonic crystals where local heating or pressure may be used to shift the direction of light propagation. Photonic crystals are microstructured photonic devices that have surprising wave-guiding capabilities and are expected to become the basic building blocks in future optical chips and other optical devices.

Whereas the field of optimization of mechanical systems is an old and well-established discipline, only few works have been performed on systematic synthesis and optimisation of photonic systems and even less work has been published on the optimisation of combined photonic and mechanical systems.

The research project is focussed on the development and applications of synthesis methods for optomechanical systems with emphasis on photonic crystals. The main tool will be the topology optimisation method which originally was developed for mechanical design problems but has been recently extended to multi-physics problems and photonic crystal design problems by the applicant. Research issues will include efficient coupled modelling by the Finite Element Method, development of optimisation problem formulations, development of efficient design parameterizations, applications in a broad range of optomechanical systems and collaborations with research groups and companies that have experimental and manufacturing facilities.

Comments:

A very original approach to combining mechanical and photonic structure optimization, which shows great promise. An excellent illustration of a cross disciplinary approach.

A very strong candidate. A very experienced and established leader in the field, with a significant international reputation and the ability to become a world leader.

Highly innovative. The introduction of rational design methods in photonic design can bring a real breakthrough in photonic engineering and applications. Excellent links to industry. The proposal is clearly explained, the work well planned and the objectives are achievable. Preliminary results are encouraging.

The host institution offers excellent academic and industrial environment.

Nationality: Danish
Address: Department of Mechanical Engineering, Solid Mechanics,
Technical University of Denmark, Nils Koppels Alle, Building 404, DK-2800 Lyngby, Denmark

Current institution: Technical University of Denmark
New institution: Technical University of Denmark

Media Enquiries:

Jens Degett, ESF Communications Director
European Science Foundation, Strasbourg, France
Tel: +33 (0)3 88 76 71 32 – Fax: +33 (0)3 88 37 05 32 Email: jdegett@esf.org