Spécialité de Master « Optique, Matière, Plasmas »

Stage de recherche (4 mois minimum, à partir de début mars 2012)

Proposition de stage pour l'année 2011-2012 (ne pas dépasser 1 page)

Date de la proposition : 06/11/2011

Responsable du stage / *internship supervisor*:			
Nom / *name*:	GRILLOT	Prénom/ *first name* :	FREDERIC
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Nom du Laboratoire / *laboratory name*: Laboratoire Traitement et Communication de l'Information (LTCI)

Code d'identification : UMR 5141	Organisme : CNRS

Site Internet / *web site*: http://www.ltci.telecom-paristech.fr/

Adresse / *address:* TELECOM PARISTECH, 46 rue Barrault

Lieu du stage / *internship place*: PARIS 13ème

Titre du stage / *internship title*:
Numerical Modeling of Injection-Locked Semiconductor Ring Laser for Broadband Applications

Résumé / *summary*
The continuing increase of transmission rates at all levels of telecommunication networks and fiber-based RF photonic systems raises the demand for very high-speed, low-cost optical transmitters. Injection locking has been actively researched for its potential to improve ultrahigh frequency performance of semiconductor lasers and to reach beyond the record values of modulation bandwidth achieved for free-running devices. The highest experimentally observed 3-dB modulation bandwidth of ~80 GHz, which by far exceeds those achieved for free-running devices, has been reported in injection-locked vertical-cavity surface-emitting lasers (VCSELs). Strong optical injection is crucial for reaching the ultimate limits of modulation bandwidth enhancement in injection-locked lasers. The smallest possible values for both cavity roundtrip time and reflectivity of the mirror used for injection would be ideal for that. While injection-locked VCSELs benefit greatly from very short cavities and, hence, very small cavity roundtrip time, their high-speed performance is compromised by very high mirror reflectivity of a typical VCSEL. To overcome these limitations of VCSELs, a novel strong injection-locking scheme involving a distributed Bragg reflector (DBR) master laser monolithically integrated with unidirectional ring laser has been recently proposed. Unidirectional semiconductor ring lasers (USRLs) are ideal for this particular application, as they can be designed for minimal back reflections, while simultaneously allowing for a strong injection from the DBR into the ring laser. However as the injection strength is increased, a pre-resonance dip between the DC value and the resonance causes the response to fall below the 3-dB value and limits the corresponding usable frequencies for broadband applications. Indeed the broadband regime corresponds to a delicate balance between the DC to resonance dip, the damping factor, and the resonance frequency. The objective of this internship is to develop a numerical model for injection-locked ring semiconductor laser so as to understand the origin of the dip occurring in the modulation response. The numerical model to be implemented is based on standard rate equations of the coupled system. Using a small-signal approach, modulation response will be extracted and the role of the crucial laser's parameters (such as the phase-amplitude coupling factor) controlling the dip amplitude will be investigated. Strong abilities and aptitudes for numerical modeling are mandatory for this internship.
Collaboration with Prof Marek Osinski, Center for High Technology Materials, The University of New-Mexico, Albuquerque, USA.

Ce stage pourra-t-il se prolonger en thèse ? *Possibility of a PhD* **? : NON**

Si oui, financement de thèse envisagé/ *financial support for the PhD***:**

Lasers et matière		Lumière, Matière : Mesures Extrêmes	
Optique de la science à la technologie		Plasmas : de l'espace au laboratoire	

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