CURRICULUM VITAE

INFORMAZIONI PERSONALI

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Nazionalità	Italiana
Data di nascita	23, GENNAIO, 1986

ESPERIENZA LAVORATIVA

Esperienze professionali (incarichi ricoperti e funzioni svolte)	[Iniziare con le informazioni più recenti ed elencare separatamente ciascun impiego pertinente ricoperto.]

ISTRUZIONE E FORMAZIONE

Titolo di studio	2010: Laurea specialista in Ingegneria Elettronica con 110/110 e lode
Altri titoli di studio e professionali	2008: Laurea triennale in Ingegneria Eltettronica e delle Telecomunicazione con 110/110 e lode 2005: Diploma di Liceo Scientifico con 100/100esimi

CAPACITÀ LINGUISTICHE.

PRIMA LINGUA	ITALIANO
ALTRE LINGUE	
	INGLESE
• Capacità di lettura	buono
• Capacità di scrittura	buono
• Capacità di espressione orale	buono
	TEDESCO
• Capacità di lettura	elementare
• Capacità di scrittura	buono
• Capacità di espressione orale	elementare

CAPACITÀ E COMPETENZE NELL'USO DI TECNOLOGIE *Con computer, attrezzature specifiche, macchinari, ecc.*	Computer : capacità di utilizzo come utente di sistema operativi unix; capacità di progettare in Matlab e Java, in modo buono ed elementare rispettivamente, acquisite pdurante i corsi universitari; esperienza con strumentazione elettronica ed elettroottica acquisita durante le esperienze di tesi triennale, specialistica, dottorato e laboratorio durente i corsi universitari.
ALTRO / CAPACITÀ E COMPETENZE *Competenze non precedentemente indicate.*	[Descrivere tali competenze e indicare dove sono state acquisite.]

Pubblicazioni

1. M. Simonetta, M. Soldo, M. Zanola, M. J. Strain, M. Sorel, G. Giuliani, "Measurement of Phase-Correlation between Optical Modes of Semiconductor Lasers", CLEO 2011, Monaco 22-26 Maggio 2011.

2. M. Simonetta, M. Soldo, M. Zanola, G. Giuliani, "An interferometric setup for the Measurement of Phase Correlation between optical modesof semiconductor lasers", Fotonica 2011, Genova 10-12 Maggio.

Altri titoli

ALLEGATI	Allegato 1: relazione finale del primo anno di dottorato Allegato 2: relazione finale del secondo anno di dottorato Allegato 3: Measurement of Phase-Correlation between Optical Modes of Semiconductor Lasers Allegato 4: An interferometric setup for the Measurement of Phase Correlation between optical modesof semiconductor lasers

DOTTORATO DI RICERCA IN INGEGNERIA ELETTRONICA, INFORMATICA ED ELETTRICA

RELAZIONE CONSUNTIVA DELLE ATTIVITA' SVOLTE NELL'ANNO ACCADEMICO 2010/2011

Marcello Simonetta

XXVI CICLO

Tutor: Guido Giuliani

Attività scientifica (2-3 pagine max)

1. **Misurazione della correlazione di fase fra modi ottici di laser a semiconduttore**

Onde TeraHertz e millimetriche possono essere prodotte tramite il *photomixing*, dove il batttimento di due sorgenti laser su un rivelatore fotoconduttore genera segnali con un'accordabilità che è molto più ampia di quella consentita dalle attuali tecniche elettroniche.
Tutti i metodi proposti per ridurre la larghezza di riga del segnale Thz o millimetrico generato tremite *photomixing* e soddisfare le specifiche dele applicazioni (larghezza di riga < 100 kHz, rumore di fase < 100 dBc @ 100 kHz di offset) sono basati sull'instaurazione di una stabile relazione di fase fra i modi laser originali. Una nuova tecnica per creare agganciamento di fase fra due modi di laser a semiconduttore che oscillano a ν_1 and ν_2 è la mutua iniezione assistita da *Four Wave Mixing* (FWM) generato utilizzando come pompa un terzo modo laser ausiliario a frequenza $\nu_{AUX} = (\nu_1+\nu_2)/2$.
L'attività scientifica è consistita nella messa a punto e nella sperimentazione di una nuova tecnica interferometrica in grado di misurare il grado di correlazione fra due o più modi ottici e la larghezza di riga del corrispondente segnale ai Thz. Il metodo è stato applicato a un laser Fabry-Pérot e due DFBs integrati mutuamente accoppiati.
La tecnica si basa su un interferometro di Michelson sbilanciato usato normalmente per misurare la larghezza di riga di un modo laser tramite la misura del contrasto delle frange del segnale interferometrio rivelato col fotodiodo di uscita. Quando due modi laser distinti sono lanciati nell'interferometro, il segnale interferometrco della portante ottica a $(\nu_1+\nu_2)/2$ è modulato in ampiezza dal segnale interferometrico relativo al battimento $(\nu_1-\nu_2)$. Misurando il contrasto sia della portante sia del segnale modulante per diversi sbilanci è possibile valutare la lunghezza di coerenza del segnale Thz che sarebbe generato dal battimento dei due modi su un fotoconduttore.
La misura è stata effettuata portando in aggancio di fase i modi di un laser Fabry-Perot tramite iniezione di un laser a cavità esternacon una lunghezza d'onda esattamente a metà fra quelle di due modi del F-P. La stessa misura è stata effettuata portando in aggancio i modi di due laser DFB integrati su un unico chip e con parte della cavità in condivisione, tramite iniezione in questa di un laser a cavitàa esterna. In entrambi i casi l'aumento del contrasto di modulazione prova che la mutua iniezione assistita da FWM generato dall'iniezione del laser a cavità esterna produce un aumento della correlazione di fase fra i modi di partenza. Da queste misure è stato possibile estrarre la larghezza di riga del relativo segnale Thz.
L'avvenuto aggancio è stato studiato anche tramite l'osservazione dei prodotti di FWM e degli stessi modi laser con metodo di rivelazione eterodina. La frequenza di oscillazione del laser iniettato è fissa, e lo spettro di uscita dei DFB integrati veniva modificato tramite la variazione della corrente di alimentazione della parte di cavità in comune ai due modi fino a raggiungere la condizione di aggancio. Poichè una volta agganciati la distanza fra i modi dei DFB e quello iniettato è uguale per tutto il *locking range*, è possibile in questa regione osservare un cambiamento nel segno della derivata $d\lambda/dI$ per uno dei due modi.

2. Generazione di un segnale interferometrico con un'antenna fotoconduttiva

La generazione di segnali THz tramite *photomixing* è possibile attraverso l'utilizzo di antenne fotoconduttive: modi laser con una differenza di frequenza pari a quella del segnale che si vuole generare illuminano il gap fotoconduttivo fra i due elettrodi dell'antenna. Se il tempo di vita dei portatori nel materiale semiconduttore (AsGa) è breve, è possibile modulare la conduttanza con una frequenza THz e se l'antenna è alimentata con una tensione continua, si genera una corrente THz. Allo stato dell'arte due diversi dispositivi sono necessari per generare e rivelare un segnale THz con antenne fotoconduttive, illuminando ciascuno di essi con una porzione dei due modi laser. L'attività di ricerca svolta ha studiato la possibilità di realizzare un setup *self-coherent* per generare e rivelare il segnale con il medesimo dispostivio. È possibile dimostrare che illuminando l'antenna generatrice con la riflessione del segnale THz, si origina una componente di corrente DC proporzionale a una funzione sinusoidale della differenza di fase fra la modulazione della conduttanza e il segnale THz riflesso. In seguito ad alcune misure sperimentali che ho realizzato presso l'Università Tecnica di Darmstadt, l'attività di ricerca si è occupata dello studio teorico delle sorgenti di rumore in questo tipo di dispositivi.

Attività di formazione (specificare/giustificare anche eventuali discrepanze rispetto al piano formativo approvato dal Collegio Docenti)

Insegnamenti seguiti e esami sostenuti: Microelettronica a Radio frequenza (**9 CFU**), Prof. Francesco Svelto, Corso di laurea in Ingegneria Elettronica.

Partecipazione a seminari, congressi e scuole

Presentazione di lavori a congressi naz. o internaz.: CLEO EU (Conference on Lasers and Electrooptics Electronics, Europe) 2011, Monaco 22-26 Maggio: presentazione orale (**1 CFU**)
5 seminari da 0.2 CFU (totale: **1 CFU**)
Austrian-Italian Workshop on "Future Internet Challenges" (**0.4 CFU**)

Seminari e presentazioni tenuti

Soggiorni all'estero [di durata superiore alle due settimane]

4 mesi (maggio - agosto) presso l'Università Tecnica di Darmstadt per effettuare misure preliminari nell'ambito dell'attività **Generazione di un segnale interferometrico con un'antenna fotoconduttiva**.

Elenco delle pubblicazioni (suddivise per anno dall'inizio del Dottorato)

1. M. Simonetta, M. Soldo, M. Zanola, M. J. Strain, M. Sorel, G. Giuliani, "*Measurement of Phase-Correlation between Optical Modes of Semiconductor Lasers*", CLEO 2011, Monaco 22-26 Maggio 2011.
2. M. Simonetta, M. Soldo, M. Zanola, G. Giuliani, "*An interferometric setup for the Measurement of Phase Correlation between optical modesof semiconductor lasers*", Fotonica 2011, Genova 10-12 Maggio.
3. M. Simonetta, M. Zanola, M. Soldo, M.J. Strain, M. Sorel, G. Giuliani, "*Mutual locking of two integrated DBR lasers operating at different wavelengths via Four-Wave Mixing*", in preparazione

DOTTORATO DI RICERCA IN INGEGNERIA ELETTRONICA, INFORMATICA ED ELETTRICA

RELAZIONE CONSUNTIVA DELLE ATTIVITA' SVOLTE NELL'ANNO ACCADEMICO 2011/2012

Marcello Simonetta

XXVI CICLO

Tutor: Guido Giuliani

Attività scientifica (2-3 pagine max)

1. **Realization of an integrated optical isolator**

I took part to a research group that demonstrated the possibility to realize an integrated optical isolator. According to the present state of the art, no way is known to integrate an optical isolator on the same chip of an optical circuit, together with lasers, attenuators, couplers and soa's (semiconductor optical amplifiers). Given the strong need for compact, small and all-on-one-chip devices, our idea is quite innovative.
The principle on which this new device is based is the different FWM (Four Wave Mixing) efficiency that co- and counter-propagating waves exhibit when launched into a soa. It was the first time that this principle was demonstrated with experimental measurements.
The idea is to be able to create an isolated coherent source, whose light, at λ_s, is generated through a FWM process of two integrated laser modes (λ_1 λ_2) injected into an integrated soa. If λ_s is the one mode allowed to escape from the device, any back reflection will cause a portion of the output signal re-enter the soa travelling in an opposite direction with respect to λ_2.
Since in a non linear semiconducctor the FWM efficiency of two counter-propagating waves is very small, only a small clone at λ_1 is generated. This will create only slight perturbation in the source, which is therfore still able to generate a pure and unperturbate output at λ_2.
We demonstrated that this technique ensures an isolation of 20 dB.

2. **Realization of an interferometric THz measuring configuration with a photoconductive antenna**

THz signal generation is possible through photomixing on photoconductive antennas. To do that a photoconductive gap is illuminated by two laser modes with a frequency separation equal to the frequency of the desired THz signal. If the recombination time of the carriers in the semiconductor is fast, the photoconductance is modulated at a THz frequency and if the antenna is biased with a DC voltage, a THz current is generated. At the state of the art two different devices are needed to generate and reveal a THz signal with photoconductive antennas, each of them illuminated with a portion of the two laser modes. In my research, the realization of a self-coherent setup to generate and reveal the signal with the same device is studied. It is possible to theoretically demonstrate that illuminating the THz generator with the bakreflected THz beam induces a dc current component. This is proportional to a sinusoidal function of the phase difference between the conductance modulation and the reflected THz beam.
The research activity was mainly a theoretical study and scientific literature analysis about the state of the art of PCAs excited with two CW laser modes at 1500 nm. In particular, the difference between planar and MESA structure.
Eventually, I built an all fiber set up for illuminating a PCA with laser light at 1500 nm. The measurements are currently being done.

Attività di formazione (specificare/giustificare anche eventuali discrepanze rispetto al piano formativo approvato dal Collegio Docenti)

Insegnamenti seguiti e esami sostenuti:

Partecipazione a seminari, congressi e scuole

- Summer School "STELLA 2012," "School for Training in Experiments with Lasers and Laser Applications," University of Pavia, July 25-29, 2012. (**8 CFU**).
- International Doctoral School on "Advanced Topics in Electrical and Electronic Engineering and Informatics," Sala delle Mostre Temporanee - Museo della Tecnica Elettrica, Via Ferrata, Pavia, September 25-28, September 2012.
- 17 seminari da 0.2 CFU (totale: **3.4 CFU**)

Seminari e presentazioni tenuti

- 4 oral contributions to the organization of the scientific event "ONDIVAGHIAMO" held at Sala Giunta dell'Unione Industriali di Bergamo, October 1-16, 2011. (**1 CFU**)

- 4 oral contributions to the organization of the scientific event "ONDIVAGHIAMO 2.0" held at Aula 4 of Engineering Faculty of the University of Pavia, February 1-10, 2012. (**1 CFU**)

Soggiorni all'estero [di durata superiore alle due settimane]

Elenco delle pubblicazioni (suddivise per anno dall'inizio del Dottorato)

First year

1. M. Simonetta, M. Soldo, M. Zanola, M. J. Strain, M. Sorel, G. Giuliani, "*Measurement of Phase-Correlation between Optical Modes of Semiconductor Lasers*", CLEO 2011, Monaco 22-26 Maggio 2011.

2. M. Simonetta, M. Soldo, M. Zanola, G. Giuliani, “*An interferometric setup for the Measurement of Phase Correlation between optical modesof semiconductor lasers*”, Fotonica 2011, Genova 10-12 Maggio.
3. M. Simonetta, M. Zanola, M. Soldo, M.J. Strain, M. Sorel, G. Giuliani, “*Mutual locking of two integrated DBR lasers operating at different wavelengths via Four-Wave Mixing*”, in preparazione

Second year

Measurement of Phase-Correlation between Optical Modes of Semiconductor Lasers

Marcello Simonetta[1], Marco Soldo[1], Marco Zanola[1, 2], Michael J. Strain[2], Marc Sorel[2], Guido Giuliani[1]

[1]*Dipartimento di Elettronica, Università di Pavia, Via Ferrata 1, 27100 Pavia, Italy. e-mail: guido.giuliani@unipv.it*
[2] *Department of Electronics and Electrical Engineering, University of Glasgow, Glasgow G12 8LT, U.K.*

Millimeter- and Terahertz-waves can be conveniently generated by photomixing, where the beating of two laser sources onto a photoconductive detector generates signals with a tunability that is much wider than what typically allowed by electronic techniques. Several methods have been proposed to reduce the linewidth of the mm-wave and THz-wave signals generated by photomixing, in order to meet applications' requirements (linewidth < 100 kHz, phase noise < 100 dBc @100 kHz offset) [1], and all of them are based on inducing a stable phase relationship between the original laser modes. A novel method to phase-lock two semiconductor laser modes oscillating at ν_1 and ν_2 is represented by mutual injection-locking assisted by Four Wave Mixing (FWM) generated using a third auxiliary mode at $\nu_{AUX} = (\nu_1+\nu_2)/2$ as pump [2].

In this work we report on an experimental interferometric technique capable to measure the degree of phase correlation between two or more laser modes and to measure the linewidth of the corresponding THz-wave signal when the modes are photomixed. The method is applied to a Fabry-Perot laser and two mutually-coupled integrated DFBs.

The technique is based on the unbalanced Michelson interferometer set-up typically used to measure the linewidth of a laser mode by the measurement of the fringe contrast of the interferometric signal detected at the photodiode. When two distinct modes are launched in the interferometer, the interferometric signal of the optical carrier at $(\nu_1+\nu_2)/2$ is amplitude-modulated by the interferometric signal related to the beat signal at $(\nu_1-\nu_2)$. By measuring the contrast of both the carrier and the modulating beat signals for different interferometer unbalances, it is possible to evaluate the coherence length of the THz-wave signal that would be generated by beating the two modes onto a photoconductor.

Fig. 1 reports a simulated interferometric trace showing both the carrier contrast and the modulation contrast. Fig. 2 shows experimental traces measured for a FP laser emitting on 5 longitudinal modes for two cases: free-running (2a), and under injection by an external laser with a wavelength exactly midway between two modes of the FP (2b). The increased modulation contrast of Fig. 2b proves that the FWM induced in the semiconductor active medium by the externally injected laser improves the correlation between the modes of the FP. In addition, the modulation contrast of Fig. 2a suggests that, also without injection, the longitudinal modes of the FP laser are already partially phase-locked.

Finally, Fig. 3 reports the measured modulation contrast as a function of interferometer unbalance for two DFBs fabricated on the same chip that are mutually coupled (see inset for device geometry). The extrapolated coherence length is 180 m, corresponding to a linewidth of less than 600 kHz for the beating signal @ 0.77 THz. This suggests that the two DFBs are strongly phase-locked, as their individual linewidth is 4 MHz (measured by heterodyne method).

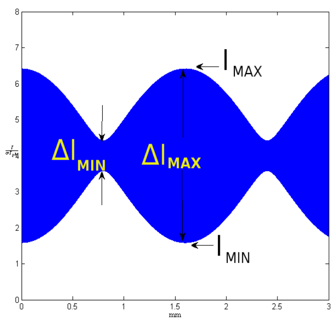

Fig. 1 The carrier contrast is defined as (Imax-Imin)/(Imax+Imin); the moudulation contrast is defined as (ΔImax-ΔImin)/(ΔImax).

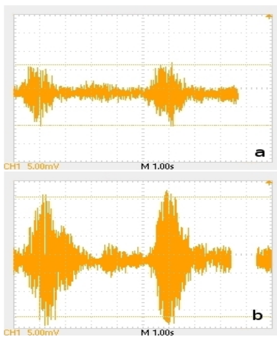

Fig. 2 Interferometric signal generated by the modes of a F-P laser with an external laser injected between two of them (6.5 meters of interferometer unbalance). a) no injection. b) optical injection, modes locked

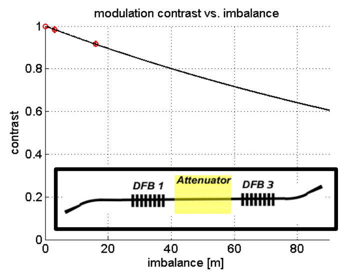

Fig. 3 Measured modulation contrast vs. interferometer unbalance for two mutually-coupled integrated DFB lasers, yielding the coherence length for the beat signal at 0.77 THz.

3.References

[1] A.J. Seeds, "Microwave photonics", IEEE Transactions on Microwave Theory and Techniques, vol. 50, no. 3, pp. 877-887, 2002.
[2] M. Soldo, M. Zanola, M. J. Strain, M. Sorel, G. Giuliani, "Integrated device with three mutually coupled DFB lasers for tunable, narrow linewidth, mm-wave signal generation ", Proceedings of CLEO/QELS 2010.

An Interferometric Setup for the Measurement of Phase-Correlation between Optical Modes of Semiconductor Lasers

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Dipartimento di Elettronica, Università degli Studi di Pavia, Via Ferrata 1, 27100 Pavia, Italy
e-mail: *guido.giuliani@unipv.it*

M. J. Strain, M. Sorel
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We present an interferometric technique for the measurement of the phase correlation between optical modes of injection-locked semiconductor lasers, that allows to determine the spectral characteristics of THz-wave signals superposed to optical carriers.

1. Introduction

In the last decade many optical techniques for the generation of mm-waves signals have been studied. Most of them are based on the generation of Radio-Frequency signal by the beating of two optical modes of semiconductor lasers on a fast photodiode or a ultra high-speed photomixer, obtaining a current signal oscillating at the frequency difference of the modes. This frequency difference can be conveniently adjusted to obtain signals up to the THz range. The applications of these signals to wireless communications, car-borne anti-collision radars, or local oscillators for astronomic antennas, require high spectral purity (linewidth below 100 kHz, and phase noise < 100 dBc @ 100 kHz offset) [1] that is difficult to obtain with the basic photomixing technique. More complex schemes have been developed to meet the applications requirements that involve the phase correlation of the optical modes in order to obtain narrower linewidth of the photomixed signal, but all these methods require the use of an external reference RF signal.
To get rid of the reference RF signal, we demonstrated a new technique based on the mutual injection-locking of three DFB lasers via Four-Wave Mixing, that generate signals up to hundreds of GHz with narrow linewidth [2]. However, at these frequencies it is not straightforward to measure the spectral characteristics of the generated beating signals using conventional techniques. Here, we report on an interferometric technique for the study of the phase correlation of the optical modes that allows to spectrally characterize the THz signals superposed to an optical carrier.

2. Interferometric Setup

The technique is based on the unbalanced Michelson interferometer set-up (Fig.1) typically used to measure the linewidth of a laser mode by the measurement of the fringes contrast of the interferometric signal detected at the photodiode. When two distinct modes are launched in the interferometer (Fig.2 shows a simulated signal), the interferometric signal of the optical carrier at $(v_1+v_2)/2$ is amplitude-modulated by the interferometric signal associated to the beat signal at (v_1-v_2). By measuring the contrast of both the carrier and the modulating beat signals for different interferometer unbalances, it is possible to evaluate the coherence length of the THz-wave signal that would be generated by beating the two modes onto a photoconductor.
The fringes contrast is defined (Fig 2) as $C_C=(I_{max}-I_{min})/(I_{max}+I_{min})=(\Delta I/2)/I_{avg}$, where I_{max} and I_{min} are respectively the maximum and minimum values reached by the photogenerated current varying the interferometric phase.
In the presence of a modulated signal, it is possible to define a modulation contrast as $C_M=(\Delta I_{max}-\Delta I_{min})/\Delta I_{max}$, where ΔI_{max} is the maximum excursion of the carrier and ΔI_{min} the minimum excursion of the carrier.

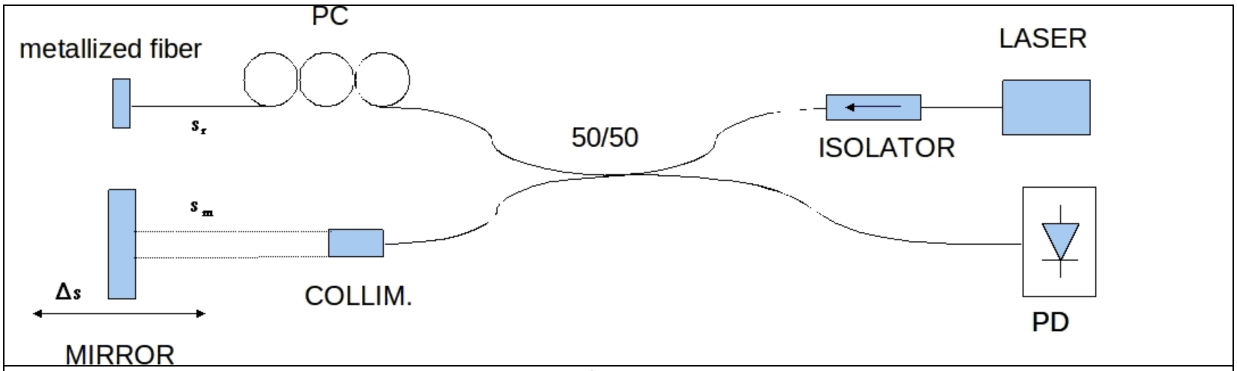

Fig.1 Interferometric setup

The observation of the signals generated with the interferometer (and more precisely, of the fringes and modulation contrasts) gives information on the correlation of the modes, their spacing and the number of interacting modes.

3. Measurement Techniques

There are two main parameters of THz-signals measurable with the interferometric technique:

- Linewidth of the photomixed signal;
- Oscillating frequency of the photomixed signal, given by the period of the interferometric signal.

For a laser with a Lorentzian emitting line [3], the fringes visibility and the coherence time exhibit the negative exponential relation: $C \propto e^{-T/T_{coh}}$, and $T_{coh} \approx 1/\pi\Delta\nu$. When an optical signal is launched in the interferometer, one can determine which is the unbalance of the measurement arm that generates a contrast below a determined threshold and estimate from this unbalance the coherence length and time and, consequently, the signal linewidth.

When there are several modes interacting in the interferometer, one must study the behavior of the fringes contrast $C_C=(I_{max}-I_{min})/(2I_{avg})$, that gives information of their average linewidth, and the modulation contrast C_M, that depends on the RF linewidth.

Also, when two modes are phase-correlated, a narrowing of the beating linewidth is expected, and the fringes and modulation contrasts are expected to increase compared to the non correlated case.

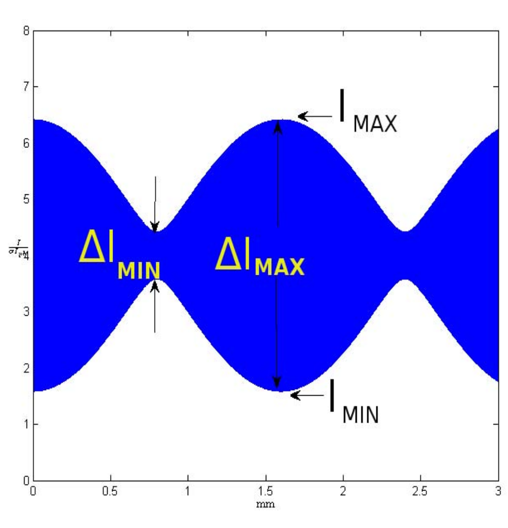

Fig.2 Simulated interferometric signal generated by two optical modes.

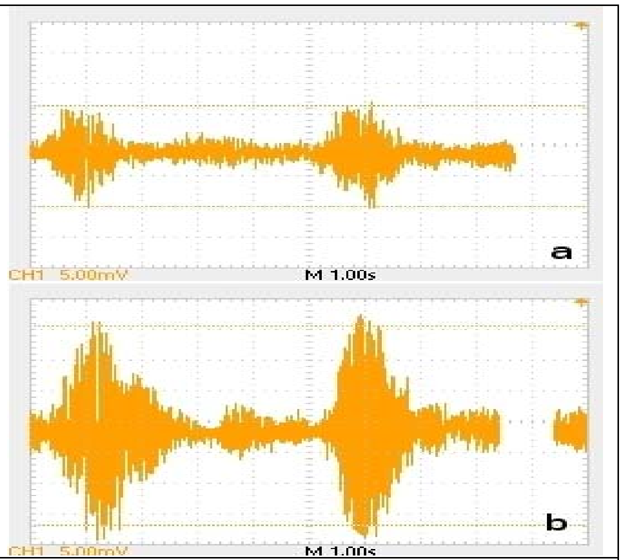

Fig.3 Interferometric signal generated by the modes of a F-P laser: a) free running case, b) optical injection by an external laser.

4. Experimental results

This technique has been applied to study the correlation between the modes of a Fabry-Pérot semiconductor laser and the correlation between the modes of two mutually locked DFB lasers of the integrated device for the generation of mm-waves signals. Starting with the F-P laser, the power of the modes travelling on the two arms was controlled by the alignment of the mirror, while the polarization was adjusted by a Polarization Controller positioned on one of the arms. The contrasts were measured for different unbalances (0, 2, 5, 8 m) and different bias currents of the F-P.

The modes of the F-P had a central frequency of 1590nm and a Free Spectral Range of 0.8nm, corresponding to a beating signal at the frequency of about 95GHz. In Fig.3a and Fig.3b are reported two interferometric signals obtained lunching five modes of the laser injected by an external laser at a wavelength respectively not exactly midway between two modes (Fig3a) and exactly midway (Fig3b). The increased modulation contrast in the injected case proves that the correlation between the modes of the F-P is improved by the FWM induced in the semiconductor active medium. Other measurements of the modulation contrast, made with the F-P laser modes free running, show that the modes of the F-P laser are naturally correlated, as the modulation contrast value is analogue to that measured in the case of injection locking assisted by FWM generated by the external cavity laser.

The same analysis has been repeated for the DFB of the integrated device. This device (Fig.4) is formed by three integrated DFB lasers mutually injected. DFB1 and DFB2 are phase locked thanks to the FWM signals generated by their interaction with DFBAUX. The beating of the phase locked modes of DFB1 and DFB2 on a high speed photodiode is expected to generate THz waves with narrow linewidth. The preliminary experiment of the application of the interferometric technique has been carried out in the case of only two mutually coupled integrated DFBs on a specifically designed device (Fig.5). The extrapolated coherence length is 180 m, corresponding to a linewidth of less than 600 kHz for the beating signal @ 0.77 THz. This suggests that the two DFBs are strongly phase-locked, as their individual linewidth is 4 MHz (measured by heterodyne method).

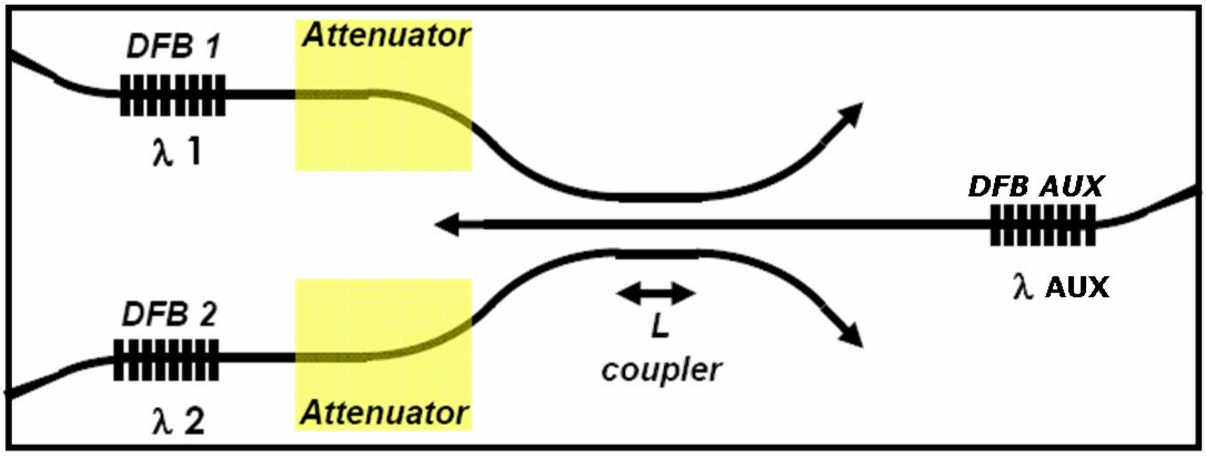

Fig.4 Integrated device for the generation of mm-waves signals with three mutually coupled semiconductor laser

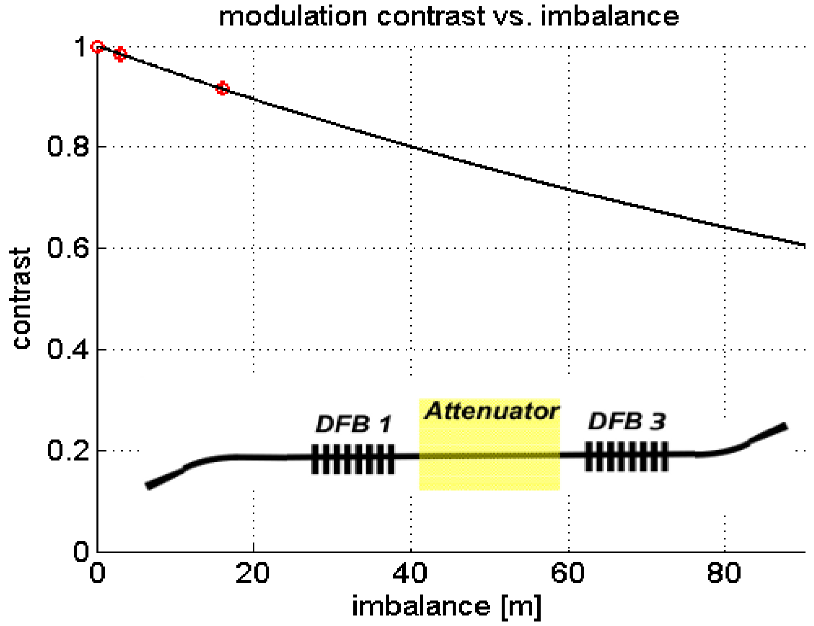

Fig.5 Behavior of the modulation contrast as a function of the interferometer unbalance for the two mutually coupled integrated DFB lasers (arranged as shown in the inset) The obtained coherence length is 180m.

5. Conclusions

In this work we have reported an interferometric technique for the study of the correlation of two or more optical modes of semiconductor lasers. This technique gives us information about the correlation and the spectral properties of the modes and the RF-signal generated by their beating. We described the parameter of interest of the generated interferometric signal and the measurement technique. We also reported two distinct case where this technique allows us to measure the correlation of the modes of a F-P semiconductor laser and the linewidth of the signal generated by their beating. Also, we where able to measure the linewidth of the RF-signal generated by two mutually coupled integrated DFBs.

References

[1] A.J. Seeds, “Microwave photonics”, IEEE Transactions on Microwave Theory and Techniques, vol. 50, no. 3, pp. 877-887, 2002.

[2] M. Soldo, M. Zanola, M. J. Strain, M. Sorel, G. Giuliani, “Integrated device with three mutually coupled DFB lasers for tunable, narrow linewidth, mm-wave signal generation ”, Proceedings of CLEO/QELS 2010.

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COMPONENTE SENATO ACCADEMICO	Indennità di Carica	Gettone di presenza per seduta
Dott. Marcello SIMONETTA		€ 83,43