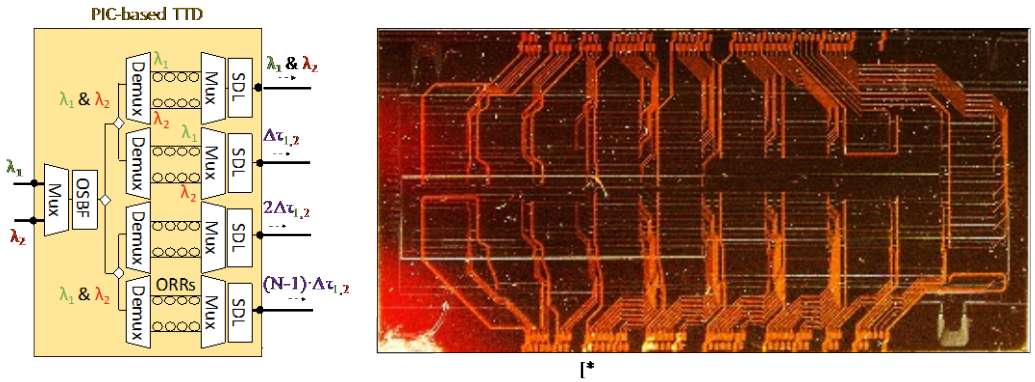
NANOPHOTONICS TECHNOLOGY CENTER

Description of the group

The Optical Networks and Photonic Systems Group is one of the seven research groups within the Nanophotonics Technology Center of the Universitat Politècnica de València. The group is led by Prof. Roberto Llorente and it is focused on the development of novel network architectures, new modulation and multiplexing schemes, the study of novel optical transmission media, and the development of novel photonic devices with advanced functionalities targeting to maximise the network capacity in core, metro and access networks, and also for cellular optical transport, where specific technologies are developed for both backhaul and fronthaul segments. The group addresses top-down architectural work, and also key bottom-up photonic technologies as modal converters or optical beamformers. The group is gender-balanced, being currently formed by female researchers at about 50%.

Optical transmission is the foundation of modern networks for access, metro, core and cellular transport. The interest to increase the network capacity in a cost- and energy-efficient way has increased exponentially recently due to the exceptional sanitary conditions. Transmission technology in the state of the art is targeting higher frequency bands, using larger bandwidths, and is designed considering seamless support of parallelization schemes as MIMO based on digital signal processing. Research in the group targets to enable very high frequency bands employing novel optical up-/down-conversion schemes operating jointly with optical beamformer systems targeting to compensating the increased atmospheric attenuation. Novel comb-based network architectures play a key role in this scenario.



[* [Ref] A. Trinidad, et al., "Broadband photonic integrated multi-RF beamformer for K-band applications," ECOC 2019

Our current research interest is focused in developing and demonstrating experimentally novel photonic architectures based on reconfigurable, high-frequency, large bandwidth photonic integrated circuits (PIC) implementing beamforming networks assisted by novel optical transmission media [1-5]. The work is expected to be done in the context of R&D projects in collaboration with European partners (Technical University of Eindhoven, University College London, etc.) in the framework of national and international research projects. A short research stay in a foreign laboratory is possible provided availability by the candidate.

Selected recent publications

1. Morant, M., Gonzalez-Guerrero, L., Renaud, C. C., & Llorente, R. (2021, March). **Multicore fiber-assisted photonic sub-THz generation for full-duplex wireless transmission.** In *Broadband Access Communication Technologies XV* (Vol. 11711, p. 117110N). International Society for Optics and Photonics.
2. Guerrero, L. G., Morant, M., Li, T., Fice, M. J., Seeds, A. J., Llorente, R., Renaud, C. C. (2020). **Integrated wireless-optical backhaul and fronthaul provision through multicore fiber.** *IEEE Access*, *8*, 146915-146922.
3. Morant, M., Trinidad, A., Tangdiongga, E., Koonen, T., & Llorente, R. (2020). **Multi-beamforming provided by dual-wavelength true time delay PIC and multicore fiber.** *Journal of Lightwave Technology*, *38*(19), 5311-5317.
4. Llorente, R., Morant, M., Bruno, J. S., & Almenar, V. (2020, January). **Software-defined beamforming enabled by spatial division multiplexing in the multicore fiber optical fronthaul.** In *Broadband Access Communication Technologies XIV* (Vol. 11307, p. 1130709). International Society for Optics and Photonics.
5. Morant, M., Trinidad, A. M., Tangdiongga, E., & Llorente, R. (2019, October). **Multi-core fiber technology supporting MIMO and photonic beamforming in 5G multi-antenna systems.** In *2019 International Topical Meeting on Microwave Photonics (MWP)*, IEEE.
6. García-Meca, C., Ortiz, A. M., & Sáez, R. L. (2020). **Supersymmetry in the time domain and its applications in optics.** *Nature communications*, *11*(1), 1-8.
7. Macho, A., & Llorente, R. (2019). **Generalized Method to Describe the Propagation of Pulses in Classical and Specialty Optical Fibers.** *IEEE Photonics Journal*, *11*(5), 1-12.
8. Morant, M., Trinidad, A., Tangdiongga, E., Koonen, T., & Llorente, R. (2019, March). **5G NR multi-beam steering employing a photonic TTD chip assisted by multi-core fiber.** In *2019 Optical Fiber Communications Conference and Exhibition (OFC)* (pp. 1-3). IEEE.
9. Garcia-Rodriguez, D., Corral, J. L., Griol, A., & Llorente, R. (2018). **Bimodal grating coupler design on SOI technology for mode division multiplexing at 1550 nm.** *Optics express*, *26*(15).
10. Macho, A., Llorente, R., & García-Meca, C. (2018). **Supersymmetric transformations in optical fibers.** *Physical Review Applied*, *9*(1), 014024.
11. Macho, A., Morant, M., & Llorente, R. (2016). **Next-generation optical fronthaul systems using multicore fiber media.** *Journal of Lightwave Technology*, *34*(20), 4819-4827.
12. Prodaniuc, C., Stojanovic, N., Karinou, F., Qiang, Z., & Llorente, R. (2016). **Performance comparison between 4D trellis coded modulation and PAM-4 for low-cost 400 Gbps WDM optical networks.** *Journal of Lightwave Technology*, *34*(22), 5308-5316.

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