Co-fund DGA Thesis

Armaments Procurement Agency

Title: Propagation control of ns pulses in multimodal fiber amplifier

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Full description

This project will address the study and control of optical nanosecond pulses through multimode fiber amplifiers. If large core amplifying waveguide is of interest to generate high energy signal, multimode propagation leads to a coherent superposition of a number of modes with scattered amplitude and phase (speckle) which is usually difficult to utilize. The main objective of the project is to control and tailor the amplified field patterns through coherent spatial shaping of the input by spatial light modulators. The project stands in the broad context of wave propagation in heterogeneous structures, a research field that one can find in microscopy for life sciences for instance, where refractive index variations of a biological tissue act as sources of scattering. Thus, most of the investigations aiming at monitoring the propagation of optical waves have considered heterogeneous “passive media” i.e. without gain. The challenge of the project is to study optical field propagation control across 3D gain structure as it is met in multimode fiber amplifiers. Beyond fundamental issues related to linear evolution as well as nonlinear behaviors connected with gain saturation, these studies also raise great expectations as they could lead to new efficient sources for remote sensing based on high power pulsed fiber lasers. Topics will be covered by both theoretical and experimental approaches.

Previous results in the group have already been published on optical field propagation through multimode or multicore fibers [1-2].

The PhD thesis will be focused first on characterization of spatial coherence of optical field from different kind of multimodal fiber amplifiers and then developments of pre-compensation system to get desired beam patterns at the amplifier output.

This subject requires good experimental skills as a lot of high technology will be used for this project like spatial shaping modulator.

This subject will also require good knowledge in laser physics, fiber optics and optical field propagation modeling.

References:

[1] J. Lhermite, E. Suran, V. Kermene, F. Louradour, A. Desfarges-Berthelemot, A. Barthélémy, “Coherent combining of 49 laser beams from a multiple core optical fiber by a spatial light modulator”, Optics Express Vol. 18, Iss. 5, (2010) pp. 4783–4789.

[2] Ph. Rigaud, V. Kermene, G. Bouwmans, L. Bigot, A. Desfarges-Berthelemot, D. Labat, A. Le Rouge, T. Mansuryan, and A. Barthélémy, “Spatially dispersive amplification in a 12-core fiber and femtosecond pulse synthesis by coherent spectral combining”, Optics Express, Vol. 21, Iss. 11, (2013), pp. 13555-13563

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Conditions of access:

- Citizen of the European Union or Switzerland;
- Not having started their professional career;
- In preparation of a Master degree in the year of submission of the application;
- Or hold a Master or equivalent allowing them to enroll in thesis;

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