RUTGERS MARLAB

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Physics-informed modeling of laser material processing and surface structuring

Position Description

Applications are invited for PhD studentships starting in September 2023. It is suitable for well-qualified students who have (or expect to obtain) a first-class degree in engineering (B.S./M.S. in Mechanical, Industrial, Materials Science, or Biomedical), physics or other relevant subject. US Citizenship or US permanent residency is preferred. The funding will be in the combined form of teaching assistantship and research assistantship. Fellowship funding may also be available for exceptional applicants (GPA >3.75). Self-funded applicants are also welcome. The candidates should have expertise and experience in at least one of the following areas: short pulsed lasers with nanosecond, picosecond or femtosecond processing, laser induced periodic surface structuring, laser micromachining, laser surface texturing, process monitoring, process optimization, advanced sensors and data analytics, statistical learning, materials and surface characterization, lasers and opto-electronics, and multi-scale finite element modeling. Minimum qualifications are; excellent oral and written communication skills, excellent programming skills, experience with machine learning algorithms. Self-motivated individuals with a strong work ethic are encouraged to apply. Good experience of numerical modeling is desirable, as is knowledge of Matlab or Python.

Research Description

Our research relates to physics-informed fundamental process understanding and control in laser surface structuring and texturing in various engineering materials. This will be explored to investigate and harvest the advantages of laser micro/nano processing for surface functionalization that comprises the following: (i) design of surfaces for different applications; (ii) modeling and set-up of laser processing parameters; (iii) tailoring the surface properties by laser radiation; (iv) characterizing the processed surfaces by different analytical methods; and, finally (v) testing the engineered surfaces in proposed applications. This project will generate new theoretical and experimental knowledge in the field of tribology behavior of surfaces generated with laser surface structuring and texturing by understanding and controlling the generation of periodic structures on ceramic/metallic surfaces using laser pulses and that will not only enable reproduction of surfaces with unique properties found in nature, but also modifying and customizing them in many engineering applications.

Multiphysics modeling, validated by experiments, is enabling us to understand the complex interactions between energy source, material, process, and the machine. The aim of this research is to extend the scope of our models to provide further insight for laser surface texturing and structuring process planning and scaling-up for cost-effective high-quality production. The research will be supervised by Prof. Tugrul Ozel (coewww.rutgers.edu/marl) and will involve close collaboration with Industry and Government Laboratories, and manufacturers.

To apply please email your CV and the names and addresses of two academic referees to ozel@rutgers.edu

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